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ANNALS *of* SURGERY

VOL. LXV JUNE, 1917 No. 6

SURGICAL EXPERIENCE AND SURGICAL KNOWLEDGE

THE ANNUAL ORATION BEFORE THE PHILADELPHIA ACADEMY OF SURGERY, FEBRUARY 5, 1917

BY JOSHUA EDWIN SWEET, M.D.

OF PHILADELPHIA

ASSISTANT PROFESSOR OF SURGICAL RESEARCH IN THE UNIVERSITY OF PENNSYLVANIA

I HAVE chosen for my text the last sentence of the seventh verse of the first chapter of the book of Dionis, entitled "A Course of Chirurgical Operations, demonstrated in the Royal Gardens at Paris," by "Monsieur Dionis, chief chirurgeon to the late Dauphiness and to the present Dutchess of Burgundy," translated from the Paris edition and printed in London in the year 1710:

"But it must be granted that the Chirurgeon, to whose lot no more than this practical Manual and Operative Chirurgery falls, will frequently run the risque of Killing and Laming his Patients, when without the Direction of a Physician; and, even in the Presence of the Physician himself, will he not be in danger of committing Faults, if his Hand be not guided by his Head? 'Tis certain, that to walk well good eyes and agile and pliant legs are requisite, and that the one without the other is insufficient for that purpose. A blind Man, for instance, provided with good Legs, and led by a quick sighted and faithful Guide, may stumble for want of Light. So, whatever Experience a Chirurgeon may have, if he have not the Knowledge which ought to direct him in his Operations, he will work in the dark; and if he be not a good Theorician, he will never prove an able Practitioner."

I have chosen this text because in conferring upon me the deeply appreciated honor of delivering this annual oration, it is to be assumed that I was supposed to have some message of interest to bring to you. If I have any such message, it is to be found in the advantageous position in which I find myself, standing midway between the theorists of the laboratory and the men of practice. This position offers me, perhaps, a slightly different point of view from that possessed by either group alone, and even makes it incumbent upon me to attempt to reconcile the opposing ideas of two, sometimes unfortunately hostile, forces.

The position is not unlike that taken by the man who feels called upon to intervene in a family quarrel; and fortunate indeed the interventionist, upon whom both sides do not finally fall, to his eternal damnation!

Is there any wrong which needs righting? I feel that there is, because for many years now I have watched young men go out from the medical schools with ideals which are certainly broader because of the improvements in the laboratory courses now in force in our medical schools. They go into our hospitals, and the next time I see them their ideals have been changed to the more narrow ideals of pure practice. The laboratory means little to them, the laboratory training in the art of acquiring knowledge has vanished, the use of books as tools seems to have been forgotten. If it be not a fact that something is wrong why does the committee of this academy find it needful to issue such an appeal as the one which we have all so recently received?

Now part of the trouble, which our committee thinks must exist, and I am sure exists, may be the fault of ourselves. We have allowed the academy to become a clearing-house of experience, rather than a clearing-house of knowledge. In part it may be due to that defect of human nature which compels men to follow a leader. If this is the case, I would fill these meetings by making the leaders of surgery promise to attend; the rest would then come. I know it does not seem to sound quite right, but my meaning may be clear to you if I say that if I wanted to catch fleas I would first catch a dog.

The chief trouble, I believe, lies elsewhere. Somewhere between the time of leaving the medical schools and leaving the years as hospital internes, someone, something, has undermined the efforts of the teachers of the medical schools to give to the students a broader point of view. Does the fault lie with the men who teach them in the hospitals, with you practical men of surgery, or does it lie with the conditions existing in our hospitals? If it is with the conditions as they exist, who shall remedy these conditions?

I have had many young surgeons come to me for special work along certain lines. They come with two desires, to do some dissecting of the human body, to learn surgical technic by practice on the living animal. Never yet has my heart been gladdened by the sight of the would-be abdominal surgeon coming to learn the physiology of the gastro-intestinal tract. Once in a while one appears with a glimmer of the value of pathology, yet without the realization that, since pathology is only physiology gone wrong, pathology cannot be understood

without knowing the basal physiology. Why is this? Has no one pointed out to them that the "when" of pathology and the "why" of physiology are of far greater importance than the "how" of anatomy? Has no one pointed out that while anatomy is the foundation stone, one who has climbed to its very top is still unable to even reach the place where the builders of to-day are working? Is it because the teaching of the writer of our text is less true to-day than it was two centuries ago, "if he be not a good theorician he will never prove an able practitioner"?

The pure theorist is not entirely free from blame. The value of pure science taught for its own sake is unquestionable, but since we are training men for medicine and surgery, the laboratory which helps in that training need not be too proud of its purity. It would seem, too, as though these exponents of pure science might more often permit us to catch a glimpse of their beloved mistresses, minus some of the veils of language and technicality. But since I am talking to you practical men, I shall refuse you the further comfort of thinking of the faults of the pure theorists. You will recall that when the mountain refused to come to that great prophet of Islam, Mohammed did swallow his pride, gird up his loins and go to the mountain.

I firmly believe that something is not right, and I further believe that this something can be expressed best by pointing out the difference between surgical experience and surgical knowledge as it is seen in a consideration of certain surgical procedures of to-day. I am aware that there is perhaps no difference between the broad definitions of experience and of knowledge, since knowledge must be defined as the sum of experience. Yet over two hundred years ago our friend Dionis perceived a difference in the common acceptation of the terms, and this difference exists to-day as then; and there certainly will be a great difference in the effect on the aspiring candidate for surgical fitness, whether you continue to emphasize the necessity of gaining surgical experience or whether you begin to point out to him by example and by precept the greater importance of gaining surgical knowledge, the sum of all human experience, which bears immediately or remotely upon the art and science of surgery.

It is so self-evident that it is banal that one must know the anatomy of a part before he can operate, but why stop there? Think for a moment of the present status of gastric surgery. The anatomists have not yet taught us the position and shape of the stomach. The Röntgenologists have taught us further that it does not make much difference where it is, so long as it is working properly. Now physi-

ology has as one of its fundamental precepts, the fact that Nature will have things go her way regardless of man's wishes in the matter; yet in spite of this fundamental fact, in spite of Kelling's [1] demonstration of this fact sixteen years ago and Cannon's elaboration of this fact eleven years ago [2]—that in the presence of a normal pylorus food will not pass out of the stomach through a gastro-enterostomy opening but through the pylorus as normally (see Figs. 1, 2, and 3)—in spite of the fact that men like our own great leaders of surgery have pointed this out and with sufficient force, I cite the paper read by our own President in December, 1914 [3]—how many simple gastro-enterostomies have been done this very day for gastric ulcer, and how many will still continue to be done for years to come, or, indeed, until our surgeons have learned to differentiate between, and rightly evaluate, experience and knowledge?

You may say that conditions are not normal in the presence of an ulcer; that a pylorospasm exists, that the operation does do good in many cases. But do you know, even, whether the operation or the real surgical rest in bed accomplished the result? Can you assure any given case that the operation will cure? Can you restore to normal unless you understand and know the normal? Are you doing 100 per cent. surgery?

Why does it take so long for knowledge to be disseminated? Why must a whole year elapse in the state of Pennsylvania before the average cancer patient sees the surgeon after he has seen the physician? Is it because the physician does not know the facts of cancer, because he has forgotten that there are other ways of acquiring knowledge beside the hopelessly narrow one of personal experience? Has he forgotten that books are tools and must be used to be kept bright? Must so many cancers of the breast be concealed from the physician until the present tendency in woman's dress fails to conceal them from the world? Will any change for the better occur until our young men can be made to see that the experience of four surgical dispensaries is of less value than the experience of one appointment, with the time that would be spent in the other three devoted to reading the wisdom of the past or to adding to the sum of knowledge by laboratory work?

Part of this difficulty is due to the methods in vogue in surgical teaching and writing. Since surgery always presents a condition in which something must be done, a surgeon must act, and he does that which seems to him best. But how often, even to his audiences of surgeons, does he say that that which he is about to do may be useless,

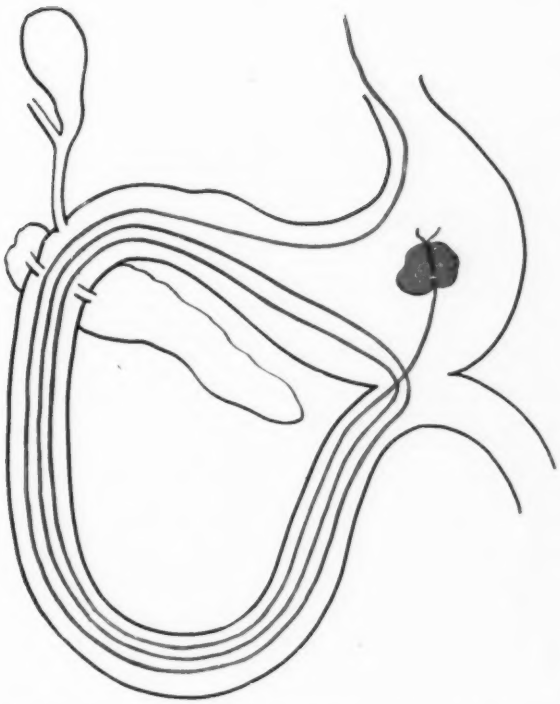

FIG. 1.—Draper's demonstration of the course followed by a bolus of food, to which a string has been attached, in an animal in which a gastro-enterostomy has previously been performed.

FIG. 2.—If the duodenum be cut and turned in at a point as indicated in this diagram, the lower end being anastomosed to the stomach by an end-to-side as shown, or by the ordinary lateral gastro-enterostomy, a certain number of these animals will die with all the symptoms of high intestinal obstruction.

FIG. 3.—Some animals operated as in Fig. 2 will live, showing at autopsy an enormous dilatation of the blind end of the duodenum or else less dilatation but extreme hypertrophy of the muscularis of the duodenum. Therefore, while food has passed through the gastro-enterostomy opening as shown by the animal's living in good health, the autopsy nevertheless reveals that nature has been insisting upon having things go her way.

is certainly irrational, but he does it because we know nothing better to do? Let me quote this sentence from a recent article on the thyroid—and every man who writes thereby becomes a teacher and must remember a teacher's responsibilities: "One indisputable fact established by recent studies stands out most prominently, and it is that goitre, with the possible exception of the colloid thyroid of adolescence, is not a disease to be treated medically but is distinctly a surgical condition." So far as I can find, the only indisputable fact concerning the thyroid, aside from the fact that we do not know its function and must needs work in the dark until we do know it, is that there is a growing dissatisfaction with the results of thyroid surgery; I mean of course with the surgery of the toxic goitre. Therefore the attempts at something more than surgical intervention, the Röntgenization of the thymus for instance;[4] therefore we read as in Mackenzie's Bradshaw lecture[5]:

"Klose published in 1913 a table giving results of operations for exophthalmic goitre by various surgeons from 1896 to 1912. The percentage of cures or considerable improvement ranges from 50 to 98.7, Th. Kocher claiming 93.7 per cent. and Mayo 97.8 per cent. The percentage of deaths allowed by Th. Kocher was 1.3 and by Mayo 2.2. These figures, I have no hesitation in saying, should be received with great reservation."

"A more convincing report has recently been published by Judd and Pemberton . . . In this the 97.8 per cent. of cures or considerable improvement has fallen to 70 per cent., but even that is, I am sure, much too high if the cases operated upon are true cases of exophthalmic goitre."

It is idle to retort that Mackenzie is only a medical man. Our medical friends are as acute observers as are we. I regret to say that as a class they are better trained in the art of acquiring knowledge; and they doubtless see more of the unsatisfactory results of thyroid surgery than does the surgeon, because the patients, having tried surgery and found it wanting, can do naught else than seek the comfort of medicine, small comfort though it may be. Mackenzie's refusal to accept surgical statistics need give no offence to the surgeon who in the past few years has been devising schemes and systems for following up his cases, since every such invention but proves anew either that he has just awakened to the necessity for finding out what he has been accomplishing, or at least, having awakened, finds his present system inadequate. We must permit others the pleasure of criticising things which we ourselves criticise in ourselves.

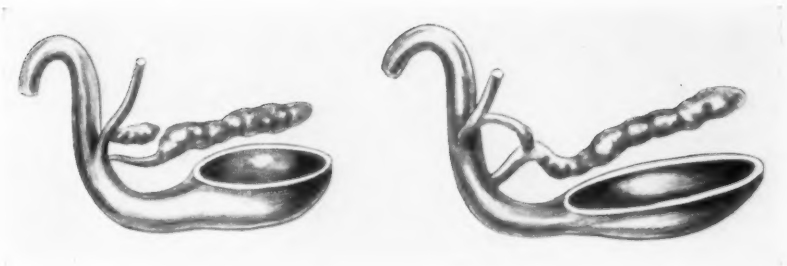

FIG. 4.—From Hamburger[7]—shows the manner in which the two portions of the pancreas, derived from separate anlagen, eventually fuse.

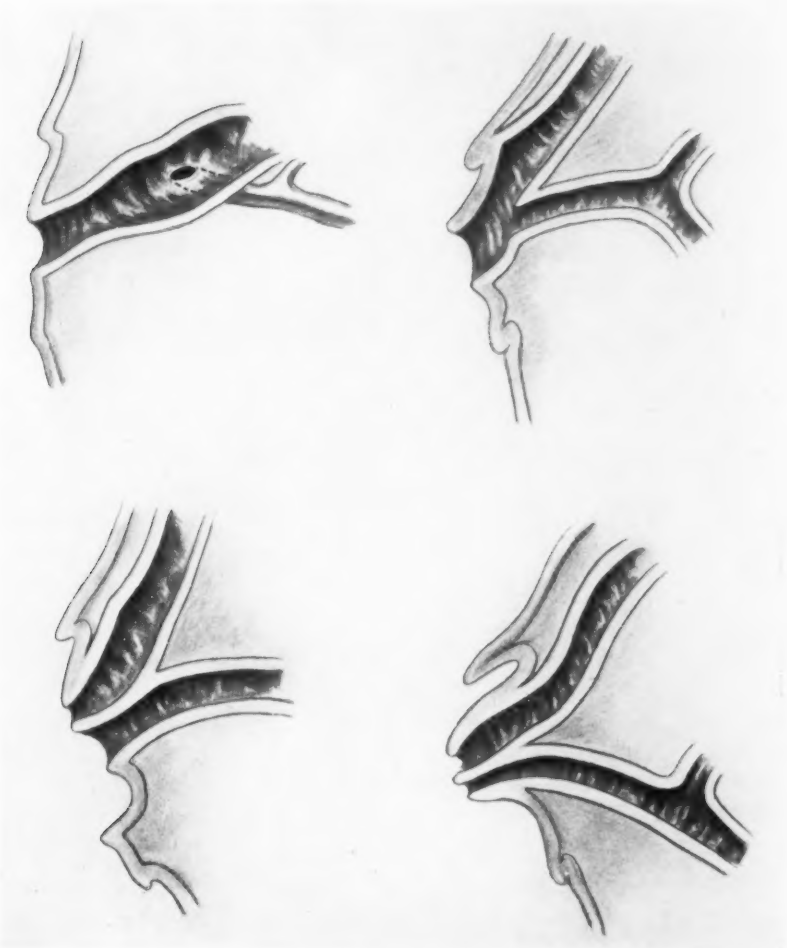

FIG. 6.—From Letulle et Nattan-Larrier[8]—the various types of the opening of the common and pancreatic ducts into the intestine.

No student of the thyroid can ignore the opinion of the internist. Whenever there are two radically opposed points of view between surgeon and internist, it means at the very least that surgery is not convincing—it is not 100 per cent. surgery. Nor can the argument hold that if these views are presented, some patients will be held until too late by the general practitioner. If the seeking for patients conflicts with the seeking for truth, we must do without the patients. We have long since emancipated surgery from the bondage of working under a physician as they worked in the days of the writer of our text. Surgery is no more the carpentry of medicine. But the habit of gently sneering at our medical colleagues, while known to be but a mild form

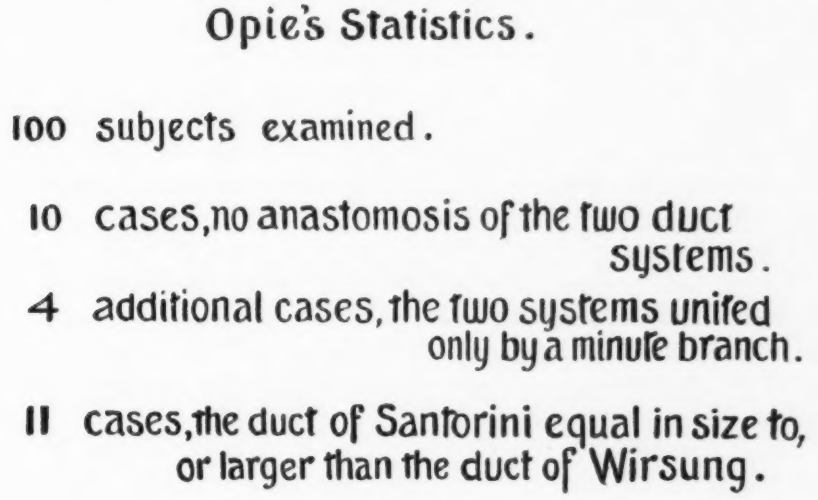
Opie's Statistics.
100 subjects examined.
10 cases, no anastomosis of the two duct systems.
4 additional cases, the two systems united only by a minute branch.
11 cases, the duct of Santorini equal in size to, or larger than the duct of Wirsung.

FIG. 5.

of mental exercise to the big minds of the leaders of surgery, is too often taken seriously by the student, to his own detriment.

The surgery of the pancreas offers several splendid examples of what I would impress upon your minds. In one of our most recent text-books, Moynihan writes,[6] in relation to the treatment of chronic pancreatitis, "The majority of surgeons follow Robson in preferring cholecystostomy, or if permanent drainage is required, cystenterostomy, if the gall-bladder is sufficiently healthy." Now such a procedure must be based upon the assumption that the infection is duct-borne, otherwise mere drainage of the duct could serve no end. It also must assume that, granting the assertion that it is duct-borne, the ducts of the pancreas could be drained through the gall-bladder. Let us look into the matter. Fig. 4 is only twenty-five years old.[7] It shows the

development of the pancreas. The surgeon who studies this picture with a thought to the vagaries of embryologic development should not be surprised to find irregularities in the pancreatic ducts. The results of Opie, Fig. 5, published in 1903,[8] are not surprising, nor need Fig. 6[9] surprise the surgeon. Yet in the ten out of one hundred cases of Opie, where the duct of Santorini drains the greater part of the pancreas, and in Fig. 6 in certain types of papillæ, there can be no doubt that neither cholecystostomy nor cystenterostomy would help. In view of these considerations alone, the drainage of the ducts could not give 100 per cent. surgery. Moynihan, in vol. iii, Keen's Surgery, reproduces Fig. 6, but fails to apply the lesson it carries to the question of treatment. Even granting that ascending infections are mucosal infections, which in any case of ascending infection they are most likely not, we might assume that chronic pancreatitis could not occur in these cases where the ducts of the pancreas enter separately from the bile-ducts, but this would need to be mere assumption.

You may say that it is easy to reason *post hoc propter hoc*, that hindsight is notoriously clearer than foresight; that since two of our own Fellows have so clearly demonstrated the true nature of chronic pancreatitis as have Deaver and Pfeiffer,[10] it is a simple matter to look backward and criticise. But the point I wish to make is that Opie's work was published in 1903, that the pictures I have shown you of the peculiarities of the openings of the ducts are from a paper of 1899, and that the peculiarities of the development of the organ, to which I drew your attention, are from a paper published in 1892. I would emphasize here what is a well-known fact to those who know books, that a text-book in any growing subject is behind the times before it leaves the printer's hands, that the surgeon must keep in touch with the original sources, and that not only in the journals devoted to surgery.

Certainly this takes time, certainly it takes effort, certainly it is something each must do for himself. You cannot hire someone to think for you any more than you can hire someone to perform many other of your personal physiologic functions. He who embarks on the surgical cruise ships for no joy-ride. If we wish to raise the standard of surgery, if we would weed out undesirables, let us get this idea clear before the minds of the aspirants to surgical success, that the real surgeon must know as much as any man in any branch of medicine and then some, this " then some " being the whole field of surgical technic.

There is no doubt that the living pathology can teach some things

that the dead pathology cannot teach, that it can teach many things better. There is no doubt that human vivisection—I use the term before a body of surgeons and do not care if over-zealous ladies wish to misinterpret it—is superior to animal experimentation, wherever it can be utilized; but living pathology does not supersede the basic pathology of the microscope. It cannot stand alone, nor is it intended by its most able exponent that it should stand alone.

The operating room teaches physiology, but not the whole subject. For instance, there can be no doubt that the whole picture of acute pancreatitis can only be explained by the activation of the proteolytic fermentogen of the pancreas, not in the intestine where the enterokinase normally activates trypsinogen into trypsin, but abnormally, in the gland itself or in the peritoneal cavity. This activation is brought about by the action of some unknown substance set free from the tissues under the conditions of autolysis. Therefore any process, infectious—though not all infections—embolic, mechanical, which can injure cells and permit autolysis may start the process of activation, and once started it is probable that the products of tryptic digestion themselves can in turn activate the fermentogen.[11] This fact is based on the evidence of painstaking researches, finished and published long before Körte wrote [12] in regard to acute pancreatitis:

"So now the majority of surgeons recommend the exposure of the inflamed pancreas; while some are satisfied with draining the surface of the pancreas by gauze and tube, others advise to go on into the diseased organ. As I have explained above, I join the latter and believe that by this means one lessens the inflammation and prevents more extensive necrosis."

Yet Körte grants but five lines to a discussion of all the work on pancreas poisoning, the understanding of which clears up so many of the problems of the surgery of acute pancreatitis. We know why injuries of the organ during digestion are more serious than at other times, there is more zymogen present to be activated. There is no need for an elaborate classification of acute pancreatitis, since the various classes into which the disease has been divided are but degrees of the same process. The problem of the time of operation becomes clear. It is a progressive process, progressing under its own power, progressing more and more rapidly as it gains headway, therefore the sooner we operate the better. The question of drainage ceases to be a question; a means of escape for the infection, which may be present or so soon will appear from the neighboring intestines, and for this activated pancreatic secretion must be provided and must extend into

the gland itself, where the trouble lies. Here more surely than Dionis ever dreamed, will the surgeon " not be in danger of committing faults if his hand be not guided by his head? "

The operating room cannot teach these facts of physiological chemistry; therefore as much as we may hate to do it we must go to the physiological chemist, begging him on bended knee to converse in words of one syllable.

Let us not forget that the greatest lesson which surgery will read out of the Great War promises to be the Dakin-Carrel treatment of infected wounds. Let us consider how this has come about. Certainly not out of the depths of the surgical experience of an experimental surgeon. It has come because Carrel possesses the genius of appropriating knowledge to the needs and purposes of surgery; and therefore he made use of the knowledge of the pure chemist Dakin. Not only that the ends of justice and fairness may be met, but that all may realize the importance of applying all knowledge to surgery, let us always think of and speak of the Dakin-Carrel treatment of infected wounds rather than the Carrel treatment. No better example of what I am trying to emphasize could be found.

Now let no one go from here thinking that I have minimized the importance of surgical experience or of surgical judgment, which can only come from a proper combination of common sense, experience and knowledge. Neither the writer of the text, nor I, nor any one in the two hundred years between us would divorce experience from knowledge. The point we would make is that the one without the other is just one-half a whole, and " if he be not a good theorician he will never prove an able practitioner."

You may tell me that the trouble lies with hospital conditions; that there is so much routine to be done that the spirit needed to encourage the search for knowledge is crushed, and all the young surgeon can hope to do is to learn what he may from experience. You may tell me that the blame for multiple hospital appointments in dispensaries and hospital services lies with the boards of managers. I will not venture into your own field, but I will point out to you that you will either change these conditions or someone will change them for you.

We hear to-day a great deal about the full-time idea in schools and hospitals. Now do not be misled that this idea is being discussed because it has been started at the Johns Hopkins and at St. Louis and is being started in Chicago; nor is it being discussed because the Rockefeller Foundation is behind it. It is being discussed because of

dissatisfaction with existing conditions, and unless these existing conditions are changed it will come here. This dissatisfaction is with the men who hold hospital appointments and give to the hospital nothing more than the gleanings of their own experience. The dissatisfaction is with the men who hold so many hospital appointments that they have not the time to give more than gleanings, even though they are capable of better things; with the men who, having ideas, have only time to pass them on to their assistants, who pass them on to the internes, who pass them on to the head nurses, who pass them on to the probationers, who pass them on to the orderlies, who pass them on to the bed-pan; dissatisfaction with the men who use the hospitals for gaining experience and never hand back to the hospital a quid pro quo in the form of crystallized experience or knowledge.

You give your time to the ward patients, you keep your appointments promptly, the wards are getting as good treatment as other hospitals, your mortality is as low, your operating staff is well trained? I should hope so—but is this enough? If you drop out to-morrow, will your hospital be any the better for your having worked there? Will the thousands who are to come be treated better because you treated the tens who were there?

These are the questions in men's minds which are leading to the discussion of the full-time idea. I do not know personally if it be the ideal; I do not know, if it were ideal in one place that it would necessarily be generally applicable. We are the servants of convention and custom in surgery as in life—even a musical comedy would fall flat among the naked natives of Africa. But I do know that something will be done to force from surgeons, in return for surgical experience, a commensurate quota of surgical knowledge.

If you do not believe that I am right, look around the country to-day, and I think you will find, without exception, that the men who are advancing the art and science of surgery are one-hospital men, that the hospitals whose names are associated with surgical progress are essentially one-man hospitals.

I do not represent any pessimism in regard to Philadelphia surgery. No city in the country, from the placid eastern coast over the western prairies to the Golden Gate, boasts as many great surgeons to the square inch as does Philadelphia. We would make it a post-graduate centre. Then remember that post-graduate centres are the outgrowth of undergraduate centres, that they do not spring full-panoplied from the head of an oil well. The undergraduate school of surgery only begins with the diploma and it is up to you who teach in

every hospital which has an interne, whether you will teach or not, to keep up the standards of the schools. You are the teachers of surgery!

I lay no claim to originality in this idea I have endeavored to present to you. I chose my text indeed from the writings of a surgeon of the long dead past. This is not the first time that this thought has been presented in this same place on this same occasion. What but this same idea prompted Ross to write in the annual oration of 1913:[13]

"Experience must set its seal deeply upon him who aspires to the heights of the surgical art. Each case must carry its lesson, however slight. The work and experience of others should be weighed in the balance.

"And granted that the surgeon has those qualifications which are so necessary to him, what is it that will enable him to further advance the science and art of surgery?

"Primarily it is the ability to profit by the experience of others, and the constant endeavor to add something new, seem it ever so trifling, to the fund of acquired knowledge."

And again, "And so the true surgeon cannot be too narrow a specialist. Specialism in modern surgery is necessary, but even more necessary is the well-grounded, thorough man who combines with his highly specialized vision openness to facts that lie beyond his immediate horizon, and an ability to interpret them."

Going back but two years more, we find the same thought underlying the annual oration of 1911, and summed up by Ashhurst in the last paragraph:[14]

"To know the wisdom and accomplishments of the past, and from them to gain a clearer vision of the needs and the possibilities of the future; to record and to study the experiences of the present, and compare them with the learning of others; to recognize the shortcomings and the disadvantages of current methods and theories, and to search for better; to let neither feeble health nor prosperity, neither the indolence of youth nor the procrastination of advancing years divert them from the path of learning and of progress; to prove all things and hold fast to that which is good: this is the patience of the saints, this is the patience of surgery."

I have ventured to presume upon this same topic to-night, because if I had any criticism of these two presentations from which I quote, it would be that they were too masterly, too scholarly, and slid softly and gently over our heads. Most of us are so constituted that the stars of heaven are not seen so clearly as are those stars perceived after

a blow on the head with an ax. My hope is that I may have brought close home to you, who are the teachers of surgery, though you may not have the title of professor, the truth of our text—"Whatever experience a surgeon may have, if he have not the knowledge which ought to direct him in his operations, he will work in the dark; and if he be not a good theorician he will never prove an able practitioner."

Coleridge says, "To most men experience is like the stern lights of a ship, which illumine only the track it has passed." Are you leaning over the stern rail, watching the turmoil of the waters raised by the propeller, not knowing whether the propeller is turning forward or backward? Get up on the bridge, steer by the stern lights of the ships that have gone before. From the bridge you can look back over your own track, seeing it perhaps the clearer if not too near. From the bridge alone can you see these stern lights of other ships. Only there can you follow the charted paths; only there can you keep your ship in line of battle.

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THE RESULTS OF THE TREATMENT OF LYMPHOSARCOMA BY MEANS OF X-RAYS AND OTHER METHODS

By Arthur Fenwick Holding, M.D.
of New York City

During the past four years it has been our privilege at the Memorial Hospital, New York City, to observe the therapeutic results obtained in over 700 cases of inoperable carcinomas, sarcomas and allied conditions treated by means of X-rays, radium, toxins, vaccines, etc. In a publication[1] based upon the critical analysis of 258 of these cases, in which the diagnosis was verified by microscopical examination, treated by the X-rays, it was shown that:

(1) Primary improvement was common in inoperable carcinomata of the skin, breast, testes, lymphosarcomata, leukæmias and pseudo-leukæmias.

(2) Most of these cases eventually relapse and die of the disease.

(3) The patient's lives were prolonged and made more comfortable.

(4) Pending the discovery of the real cure for cancer, radioactive methods give results in certain classes of cases which no other methods have ever attained or surpassed.

(5) In some instances these ameliorations were very striking and deserve particular attention in the hope that eventually we may discover means of making these ameliorations more lasting and even permanent.

This series of thirty-five cases of lymphosarcoma offers an unusual opportunity for comparing the results of different methods of treatment in this disease, and it is for this reason especially that the present report is prepared. The series includes several anatomical types, as lymphocytomas, large round reticulum cell sarcomas, tumors approaching atypical Hodgkin's disease in histology, and lesions approximating the chronic granulomas. It does not include any of the embryonal epithelial tumors (endotheliomata nor infectious granulomata) which frequently resemble lymphosarcoma so closely that they are diagnosed as such.

The writer is aware that there are many variations in the anatomical structure, locations of the lesions, and natural history of these and various types of tumors, which have an influence on their treatment. This subject will be covered in a later communication. Here I will

[1] Soon to appear in the American Journal of Medical Sciences.

merely state that the observations of ourselves and others make it logical to assume that the reason lymphosarcomas respond better to radioactive measures than any other type of sarcomas is because of the predominance of the nuclei in lymphosarcomas. It is obvious also, that the early and localized forms of this disease are the only ones that may be expected to yield favorable end results.

The accompanying table summarizes observations made in these thirty-five cases of lymphosarcoma treated by various surgical methods, including excision, radium, X-rays, mixed toxins, serums,vaccines, etc.

The ages of the patients varied from twelve to seventy years. Twenty-three cases were males and twelve were females. The duration of the disease varied from two months to seven years. In fifteen of the cases the disease first manifested itself in the tonsil; in fourteen of the cases the disease first affected the cervical glands, and in six cases other glands in the body were first affected. Cases with primary manifestations occurring in the tonsil were most malignant. Thirty of these patients are dead or dying. Five are symptomatically well. In twenty-two cases from one to five operations had been performed, and the patients presented with post-operative recurrences. In none of our cases was excision used alone. In most of our cases several methods of treatment were used as shown in the table of cases. As a rule the treatment which promised most in any individual case was first employed. If adequate improvement was not noted within a reasonable length of time the special treatment selected was superseded by some other treatment or in some instances adjuvant treatments were given in the endeavor to control the advance of the disease and in the best interests of the patients.

Experimental Methods.—Three cases were treated with autogenous vaccine derived from tumors excised from the patient; one case was treated with serum from a goat which had been given immunizing doses of a diphtheroid organism isolated from the patient's tumor; one case was treated with colloidal copper; two with other experimental methods, all of which yielded no conclusive therapeutic results.

Older Methods.—Eight cases were treated by surgical operations followed by mixed toxin treatment; of these, one has been symptom-free for four years; five are known to be dead and two disappeared from observation.[2]

Nine cases were given mixed toxin treatment at first and grew

[2] Patients suffering from malignant tumors and "disappearing from observation" as a rule are patients that have gotten no results or bad results and have become discouraged.

worse; other agents were then added to the treatment; in five of these cases the other agents resorted to were radio-active methods, and the patients made rapid improvements as soon as this change was made; one of these patients became symptom-free. The other four toxin cases which were not put on radio-active treatment did not improve. One case was treated by mixed toxin alone; he was unimproved and is now dead. Fourteen cases were treated with mixed toxin in conjunction with other methods; six were improved; six were unimproved; two disappeared from observation. Five cases were treated with Röntgen rays alone; of these, one has been symptomatically well for three years; in two the masses disappeared but later presented in other parts of the body, and both patients are now dead; the other two cases were unimproved. Twenty-three cases in all were treated with massive doses of Röntgen rays, of these fifteen were improved.

Two cases were treated with radium alone; one has been symptom-free for one year; the other was improved for a time but is now dead. Seven cases were treated with radium in conjunction with other methods; one has been symptom-free for one year; six were improved.

Cases Symptom-Free.—Five cases have been symptomatically well respectively 3 years, 4 years, 3½ years, 1, and 1 year. The first, a groin case, on exploratory operation was found to be too extensive for removal, and was treated with the Röntgen rays alone. The second was treated by surgery and mixed toxins and has been symptom-free for four years. The third, primary in the cervical glands, was treated first by operation, and followed by post-operative administration of mixed toxins. In spite of this treatment, recurrences took place. The patient was then treated with massive doses of Röntgen rays, and has been symptomatically well for 3½ years. The fourth was treated by radium over the tonsil and X-rays over both sides of the neck, axillæ and mediastinum. She has been symptom-free for one year. The fifth was treated by radium over the tonsil and neck and has been symptom-free for one year.

Cases Improved.—Thirteen cases were improved. Three were treated with Röntgen rays alone. Two were treated with Röntgen rays and radium. One was treated with radium alone; thus making a total of six cases out of thirteen improved cases due to treatment by radio-active measures alone. Three of the cases that were improved were treated at first with an autogenous tumor vaccine with improvement; they were also given Röntgen treatment. Two of the improved cases were treated with mixed toxins at first, without improvement; later they were treated with radio-active methods and improved. One of the

improved cases was treated with mixed toxins alone at first without improvement; the toxins were stopped and radium treatment instituted, under which the case improved.

Cases Unimproved.—Of the thirty-five cases, nineteen are known to be dead; one is dying; five have disappeared from observation. Thirteen cases of the thirty-four were improved for periods varying from one month to one year. Twelve cases of the series were unimproved.

It is worthy of note that this series of cases is reported from an institution in which the toxin treatment was carried out in an efficient manner and the series includes all the cases of undisputed lymphosarcoma that were treated in that institution during a period of four years. In the light of the fact that we are able to report only one case symptom-free where mixed toxins were used (combined with surgery), I am forced to conclude that some other constitutional treatment for this class of malignant tumors is as sadly needed as it has been earnestly sought. The fact that the mixed toxins act as a constitutional agent must stand in their favor, and there seems to be some evidence of a certain influence on lymphosarcoma from the use of mixed toxin treatment as indicated by an occasional cure reported by this method.

The series of cases treated in this institution demonstrates conclusively that treatment of this group of cases by the toxins is rarely effective, whereas treatment by the X-rays and radium results in marked benefit, and even in apparent recovery, in a considerable proportion of cases. Moreover, the use of the toxins entails serious discomfort, high fever, chills, and general constitutional deterioration, whereas the X-rays and radium when properly used produce no untoward effects whatever. It is apparent, therefore, that the latter method constitutes the method of choice in all cases in which it is available, and that the toxin should be resorted to only where the X-ray and radium have proven ineffective. Other treatments also failed in the majority of cases, so that our results emphasize the well-known lethal tendency of lymphosarcoma.

Among the cases that were unimproved were most of those of youthful age in whom the disease appeared to be especially aggressive. Many patients did well or even showed definite temporary improvement until there were evidences of involvement of internal viscera, when the downward progress usually became more rapid. While the general condition of the patient usually improved with shrinkage of palpable tumors, this general improvement was not always observed. One patient died with superficial tumors almost completely absorbed.

I wish to express my appreciation of the assistance rendered by the

Case No.	Age	Sex	Duration	Locus	Treatment			Symptoms: Well	Improved	Unimproved	Present status	Remarks
					Number of operations	X-ray	Other methods					
1	40	F	7 years....	Thigh, abdomen	5	X	Autogenous vaccine from tumor	..	1	..	Dead.....	Did not improve under vaccine. Did improve under X-ray treatment.
2	24	M	3 years....	Thigh, groin..	1	..	Mixed toxins. Colloidal copper	..	..	1	Dead.	
3	26	M	5 months ..	Tonsil, neck ..	1	X	Mixed toxins. Autogenous tumor vaccine	..	1	..	.....	Mass in neck diminished under X-ray treatment. Did not diminish under toxins.
4	19	M	3 months...	Tonsil, nose, pharynx, neck	.....	.....	Radium.....	..	..	1	Dead....	Radium dosage too small.
5	55	M	2 years....	Neck.....	2	..	Mixed toxins.					
6	48	F	6 months...	Groin.....	..	X	.....	1	..	..	.....	Has been symptom free 3 years.
7	55	M	1 year.....	Axilla, neck, lung	1	X	Radium.....	..	..	..	Dead.	
8	60	F	1 year.....	Tonsil.....	..	..	Mixed toxins. Radium	..	1	..	Still under treatment	Grew worse under toxins; improving under radium.
9	47	M	8 months ..	Axilla, neck, abdomen	..	..	Diphtheroid serum	..	..	1	Dead.	
10	37	M	6 weeks....	Nose, tonsil, neck	..	..	Mixed toxins.....	..	..	..	Dead.	
11	28	M	2 months...	Neck.....	1	..	Mixed toxins.					
12	42	M	6 months...	Tonsil, neck...	1	X	Mixed toxins, Radium	..	1	..	Dead	Grew worse under toxin; tumors disappeared under radium on tonsil. X-ray to neck.
13	43	M	9 months...	Spleen, neck, axillæ, groin	1	X	.....	..	1			

14	55	F	18 months..	Tonsil, neck...	1	X	.....	..	1	..	Failing...	Superficial growths have disappeared.
15	53	F	2½ years ..	Tonsil neck,...	1							
16	61	F	6 years.....	Neck, mediastinum	..	X	.....	..	1	..	Dead.....	Masses had disappeared under X-ray treatment.
17	12	M	9 weeks....	Axilla, neck...	..	X	.....	..	..	1	Dead.	
18	43	F	6 months...	Tonsil, naso-pharynx, larynx, neck	..	X	Radium.....	..	1	..	Dead.....	Masses disappeared under treatment.
19	44	M	18 months..	Tonsil, neck...	1	X	Mixed toxins. Radium	..	1	..	Dying....	Masses diminished under toxins, operative removal; recurrence while under toxins; disappeared under radium and X-rays.
20	47	F	2 years....	Groin.....	1	X	Mixed toxins.....	..	1	..	Dead.	
21	28	M	5 months...	Abdomen.....	2	X	.....	..	1	..	Dead.	
22	24	M	1 year.....	Tonsil, neck...	1	X	Mixed toxins.....	..	1			
23	44	M	15 months..	Neck	1	X	Autogenous tumor vaccine	..	1	..	Dead.....	Improvement under X-ray; not influenced by vaccines.
24	47	M	18 months..	Neck.....	1	..	Mixed toxins.....	..	..	1	Dead.	
25	51	M	6 years....	Tonsil, neck...	2	X	Mixed toxins.....	..	..	1	Dead.	
26	51	F	6 years	Neck, axilla...	..	X	.....	..	1	..	Dead.....	Masses disappeared under treatment.
27	54	M	8 months ..	Neck.....	3	..	Mixed toxins.....	1	..	..	.....	Symptom free 4 years.
28	32	M	15 months..	Neck.....	1	X	Mixed toxins.....	1	..	..	.....	Symptom free 3½ years. Did not improve under toxins.
29	21	M	5 months...	Tonsil,pharynx mediastinum	1	..	Mixed toxins.....	..	..	1	Dead.	
30	70	M	8 months...	Neck.....	1	X	.....	..	..	1		
31	..	M	5 months...	Neck.....	1	X	.....	..	1	..	Dead.	
32	45	F	17 months..	Tonsil, neck, axilla, mediastinum	..	X	Radium.....	..	1	..	.....	X-ray on neck, radium on tonsil.
33	45	M		Neck.....	..	X	.....	..	..	1	Advanced case.	
34	52	F	5 months...	Tonsil, neck...	..	X	Radium	1	..	..	.....	Symptom free 1 year.
35	40	F	3 months...	Tonsil, neck...	..	..	Radium	1	..	..	.....	Symptom free 1 year.

staff of the Memorial Hospital; without whose coöperation this work would have been impossible.

CONCLUSIONS

The following conclusions regarding the treatment of lymphosarcoma are warranted from the observations made in this series of cases:

1. Surgical excision is contra-indicated except in very early and strictly localized forms of the disease, and since such anatomical conditions can seldom be demonstrated to exist surgical treatment is very rarely admissible in this condition. It cannot be denied that in rare instances of what might well be called " incipient " lymphosarcoma early excision has eradicated the disease. Lymphosarcoma in an " incipient " stage, however, is so rarely encountered clinically, and even then is so rarely diagnosed before it has extended deeply, that the recognition of the condition, when it is a therapeutic possibility to cure it by excision, is a fortunate accident rather than a reasonable probability.

2. The most effective treatment for lymphosarcoma at present is by radio-active methods, rarely combined with surgery.

3. No treatment of this disease can be considered complete unless it includes treatment with radio-active methods.

A HISTOLOGICAL STUDY OF THE CIRCULAR SUTURE OF THE BLOOD-VESSELS

By Charles Goodman, M.D.
of New York

(From the Surgical Laboratories, Department of Surgery, College of Physicians and Surgeons, Columbia University, New York)

The purpose of this study is to obtain some light on the repair of sutured blood-vessels, and to determine upon a simplified technic which would render the circular suture of blood-vessels practicable in general surgery.

The first recognized successful suture of a blood-vessel was performed by Jassinowski, in 1889. He made use of interrupted sutures. Burci, in 1890, and Silberberg, in 1897, report similar results. The same year Murphy reported his method of invagination. Doerfler in 1889 first used the method now employed, the essential features of which were the use of fine round needles and fine silk, and the continuous sutures embracing all the coats of the vessel. Hirsch, Brian and Jaboulay were followed in 1900 by Payr, Bougle, Clermont, Tomaselli and Salvia. Berard and Carrel began to study end-to-end arteriovenous anastomosis in 1902. During the next years Jensen and Hoepfner and Floresco pursued the same studies. In 1905 Carrel and Guthrie had favorable results from their method of continuous sutures penetrating the media and intima. Other workers in blood-vessel suture were Ullman and von Decastello, Stich, Jeger, Borst and Enderlen, Lespinasse, Villard and Tavernier, Yamanoüchi, Horsley and Bernheim.

The results of arterial circular suture in animals by Borst and Enderlen, Yamanoüchi, Ward, Stich and Carrel by Carrel's method show 74.2 per cent. successes in a total of 148 cases. Sofotereff says that in 352 cases operated upon by the Carrel method, there were 49.8 relative percentage of successes, 15.5 per cent. by the Murphy method, and 17.6 per cent. by the Payr method of invagination with magnesium rings.

Of the methods described, Jeger considered Carrel's technic the best for the surgeon who has made a specialty of blood-vessel suture, but was inclined to believe that the Payr method, on account of its simplicity, would find a field of usefulness in war surgery.

Carrel's technic is as follows: "The round straight needles, Kirby No. 16, threaded with fine silk and sterilized in vaseline, are used. The

operative field is circumscribed by a black Japanese silk towel on which the fine threads can be easily seen. The temporary hæmostasis is secured by elastic clamps, forceps or rubber bands. The vessels are severed and the adventitia removed from the end of the vessels. The blood is washed out not only from the vessels but also from the operating field. The vessels and the surrounding parts are then covered with warm vaseline.

"The vessels to be sutured must be approximated without much tension. They are brought together by three retaining stitches, introduced at three equidistant points of their circumference. By traction on these threads, the circumference of the vessel can be transformed

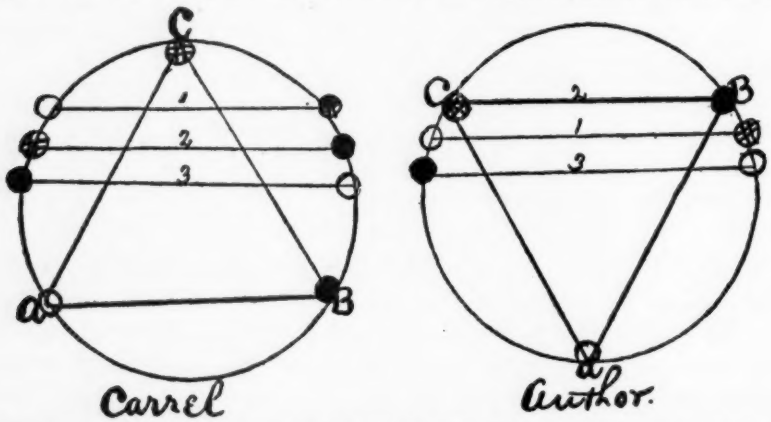


FIG. 1.—AO, first retaining and traction suture, also starting point of circular suture; B● second retaining and traction suture; C●, third retaining and traction suture. Lines 1, 2 and 3 (left figure) indicate the relative position of the corresponding sides of the triangle during the suture by Carrel's method. Lines 2, 1 and 3 (right figure) indicate the relative position of the corresponding sides of the triangle during the suture by author's modification.

into a triangle. The first retaining thread is used as a continuous suture, uniting the three sides of the triangle. During the suture great care is taken to approximate accurately the cut surfaces of section of the walls.

"In arteriovenous anastomosis the vein is generally larger than the artery. After the ends of both vessels have been approximated by the three retaining sutures with some of the stitches of the continuous suture, a relatively larger portion of the vein is taken up than of the artery, thus the caliber of the vein is progressively reduced and a good union takes place. In side-to-side anastomosis, both vessels are brought near one another, and an ellipse resected from the contiguous walls. A temporary provisional suture is introduced into the posterior margin of both vessels, but is not tied. Two retaining sutures unite either end of the openings. The ends of the retaining stitches are on the external

surface of the vessels. The union is completed by a continuous suture. Leakage during the first minutes after the circulation is restored is controlled by gentle pressure with gauze. After two or three minutes the sponges are removed, and, if some hemorrhage persists, one or two complementary stitches are added."

I believe that it is important to avoid the use of instruments in handling the severed ends of the vessels. The adventitia is drawn over the end of the vessel with fingers well oiled with paraffin, and severed with scissors.

The third side of the triangle with Carrel's method is made accessible for suture only by twisting the vessels for a distance of 180 degrees. By introducing the first retaining stitch on the posterior side so that the triangle formed by the three retaining stitches will have its apex downward, it was found that the vessels were twisted only for an arc of a quarter of a circle or 90 degrees. The importance of this feature of the technic is particularly emphasized in an attempt to anastomose the shorter vessels, such as the renal and splenic. I find that liquid paraffin is more easily handled than vaseline, especially during cold weather.

While the eversion of the vessel ends emphasized by most of the experimenters is quite essential, this detail should not be exaggerated, particularly in the anastomosis of arteries where the histological reconstruction of the continuity of the vessel should be sought for in order to assure a perfect functional result.

The results obtained seem to prove that coaptation of the respective layers of the vessel wall can be accomplished with a simple running suture. This is illustrated in a number of the specimens which attains the object with a minimum amount of cicatrix and with an almost perfect restoration of the normal integrity of the vessels. A restoration of the intima is most essential in order to eliminate as far as possible the dangers of an occluding thrombus. It cannot be denied, however, that this can be accomplished without the practice of the mattress or double mattress suture advocated by Horsley. This is shown in the histological study of the specimens. The objection to the mattress suture on theoretical grounds would be that it has a tendency to evert the severed ends of the layers of elastic tissue and muscularis. This tendency even goes so far as to eliminate the possibility of their re-entering into the continuity of the vessel wall. I have found in side-to-side anastomosis that the use of the three-bladed clamp of Jeger very much simplifies the procedure. After the vessels have been fenestrated, the introduction of an additional temporary traction suture in the anterior margins

of the openings facilitates the use of the straight needle without inflicting injury upon the exposed intima. These temporary sutures should not be tied and are readily removed after the continuous suture has been completed. The traction is produced with the weight of the serrefines.

The histological studies of the process of healing of the circular suture of vessels have been as follows:

Carrel in 1907 reported findings after autotransplantation of jugular vein to carotid. He stated that the walls were thickened and, *vice versa,* in the transplantation of artery into vein the walls become attenuated so that it might be said that the transplant eventually shows changes in its structure in accordance with the blood-pressure to which it has been subjected. Stich, Makkas and Dowmann show the thickening of the intima and proliferation of the endothelium.

Fischer and Schmieden report histological findings in transplantation of vein to carotid removed from a dog after eighty-six days. They found a marked thickening of the media due to a hypertrophy of the muscularis and connective tissue invasion. The intima was somewhat thickened over the line of suture. They also found among the spindle-cell proliferation of the intima, some cells that resembled smooth muscle cells. They note the absence of elastic fibres in all of their specimens.

Capelle states that he found proliferation of the intima with very little changes in the media or adventitia. W. Ward found that homotransplantations, similar to heterotransplantations, eventually become absorbed. The elastic fibres, however, remain intact.

Borst and Enderlen in an autotransplantation of carotid artery after 132 days report that the elastic fibres were replaced by connective tissue. There were small areas of necrosis in the media. The sutures were surrounded by granulation tissue, containing phagocytes and giant-cells. The vasa vasorum were increased in number and somewhat thickened. The elastic fibres end at the scar and show a tendency to divide into bundles. A few very delicate newly formed elastic fibres were present in the scar itself. The muscularis showed marked atrophy.

Ribbert is quoted by Borst and Enderlen as saying that a homotransplant seems to be able for a short time at least to withstand the biological differences in body juices between the donor and host. He believes that the transplant will begin to show evidences of absorption as soon as its own tissue fluids are exhausted.

Jacobsthal claims that he saw new elastic fibres appear as early as 12 days, Borst and Enderlen, 14 days, and Faykiss in 3 weeks.

Borst and Enderlen believe that the union of the vessels evidently

takes place by scar tissue. Minute small areas of necrosis have been observed in the media. Archibald Smith has also reported such a finding. "There is some danger of aneurismal formation following the cutting out of the silk sutures when drawn too tightly or when introduced under too great tension. The triangular-shaped groove formed by the eversion of the two vessel ends becomes covered with endothelium. The endothelium showed proliferation of a spindle-cell variety and can be observed within twenty-four hours. The sutures were surrounded by polymorphonuclear leucocytes and buried in the new tissue formation. Elastic fibres and muscle fibres disappear in the everted portion of the vessels while the elastic fibre of the media near the scar undergoes degeneration. A few delicate elastic fibres make their appearance later in the scar itself. We cannot therefore say that all the elements of the vessel wall are absolutely restored, but that scar tissue enters into the process of healing."

According to Aschoff, the vascular wounds are closed immediately by fibrin and platelets. "The degree of thrombosis depends upon the amount of traumatism inflicted, secondly upon the nature of the wall of the vessel (arteriosclerosis), and thirdly, the state of the circulation. The process is followed by a cellular proliferation which infiltrates and covers the thrombus. This is followed by invasion of the adventitia and media. The media is the seat of marked connective tissue and very slight muscle cell proliferation. New elastic fibres permeate the scar, especially the outer layers. An absolute restoration of the elastic and muscular tissue of the vessels seems improbable."

According to Yamanoüchi, union takes place by the formation of scar tissue with a partial preservation of the muscle cells, the elastic fibres being somewhat increased in number. He found that homotransplantations of vessels were followed by gradual degeneration and destruction of the transplant which is eventually replaced by connective tissue. The findings in No. 3529 and No. 2753 agree with those of this author.

Borst and Enderlen claim that the muscularis disappears almost entirely from the vicinity of the suture line.

The specimens No. 3846 and No. 3258 in this series show the muscularis well preserved and extending into the line of suture.

The presence of valves in a vein transplant does not necessarily favor coagulation or thrombus formation, as is demonstrated in several of these specimens (see Fig. 10, No. 2477).

The consensus of opinion is that the restoration of the intima is brought about by proliferation of the endothelium.

My specimens in which histological examinations were made include examples of end-to-end or circular sutures, side-to-side anastomosis between artery and vein, the end-to-end arteriovenous anastomosis and the transplantation of segments of vessels:

Experiment No. 40.—Fig. 2. Drawing. Low power. End-to-end suture of carotid. Dog No. 27. Surg. Path. No. 3729. Operation, November 13, 1915. Specimen removed November 22, 1915. Sutured ends separated by ½ mm. of connective tissue on one side; on the other side by 2 mm. This connective tissue at some points is dense; at other points it is loosely constructed. The intima regenerates everywhere. At one point one of the sutures lies within the vessel lumen, and is completely covered by connective tissue, with an endothelial surface. Where there was wide separation of the vessel ends, there is a considerable mass of relatively loose connective tissue on the surface which is covered with intima. In the depths the repaired vessel wall is dense and suggests osteoid structures. In the depths of the suture line at another point, very definite osteoid structure exists. There is a distinct dilatation of the lumen present at the site of the suture line.

Fig. 3. Drawing. End-to-end suture of carotid. Dog No. 27. Surg. Path. No. 3729. Operation November 13, 1915. Specimen removed November 22, 1915. Sutured ends separated by ½ mm. of connective tissue on one side; on the other side by 2 mm. This connective tissue at some points is dense; at other points it is loosely constructed. The intima regenerates everywhere. At one point, one of the sutures lies within the vessel lumen, and is completely covered by connective tissue, with an endothelial surface. Where there was wide separation of the vessel ends, there is a considerable mass of relatively loose connective tissue on the surface which is covered with intima. In the depths, the repaired vessel wall is dense and suggests osteoid structures. In the depth of the suture line at another point, very definite osteoid structure exists. There is a distinct dilatation of the lumen present at the site of the suture line.

Experiment No. 47.—Fig. 4. Drawing. End-to-end suture of carotids. Dog No. 108. Surg. Path. No. 3846. Operation January 20, 1916. Specimen removed February 9, 1916. Cicatricial tissue firmly unites one vessel end to that of the other. One extremity is slightly everted and the other is implanted upon it. The recess is so obliterated by connective tissue that the intimal lining is completely regenerated. The suture line is hardly discernible on account of the merging of the cicatrix with the sutured ends. Smooth muscle cells as demonstrated in a Van Gieson stain infiltrate the cicatrix.

Experiment No. 1.—Surg. Path. No. 2053. End-to-end suture of carotids. Dog. No. 313. Operation April 30. Specimen removed May 27. Strong dense cicatrix joins both ends. The lining membrane completely regenerated. Some bulging of vessel wall at site of cicatrix.

Experiment No. 43.—End-to-end anastomosis of carotids. Eleven days. Dog No. 56. Surg. Path. No. 3765. Operation December 9, 1915. Specimen removed December 20, 1915. Vessel wall on one side shows the ends are in perfect alignment. There is a minimum amount of scar tissue forming the suture line. On the other wall there is an eversion. The recess is filled in with fibrin and leucocytes. Cicatricial tissue firmly unites end of vessel wall to end of vessel wall.

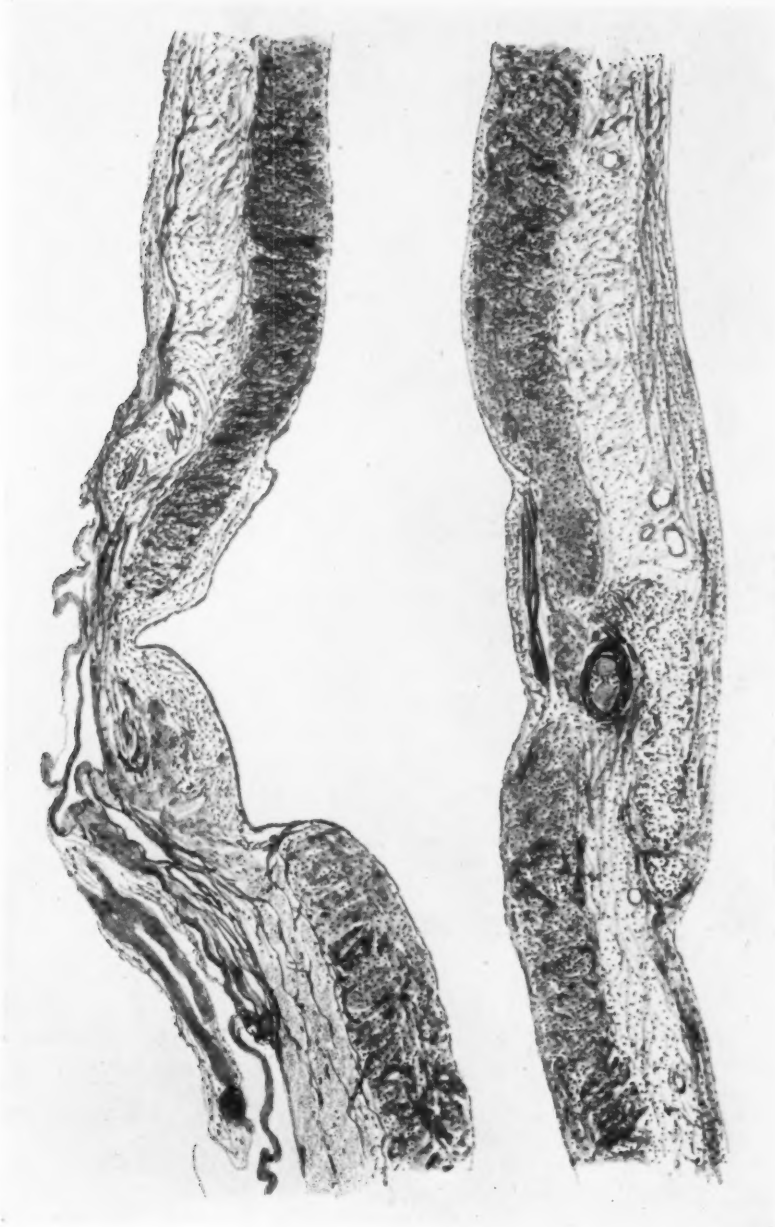


FIG. 2.—Drawing. Low power. End-to-end suture of carotid. Dog No. 27. Surg. Path. No. 3729. Operation, November 13, 1915. Specimen removed November 22, 1915. Sutured ends separated by ½ mm. of connective tissue on one side; on the other side by 2 mm. This connective tissue at some points is dense; at other points it is loosely constructed. The intima regenerates everywhere. At one point, one of the sutures lies within the vessel lumen, and is completely covered by connective tissue, with an endothelial surface. Where there was wide separation of the vessel ends, there is a considerable mass of relatively loose connective tissue on the surface which is covered with intima. In the depths the repaired vessel wall is dense and suggests osteoid structures. In the depths of the suture line at another point, very definite osteoid structure exists. There is a distinct dilatation of the lumen present at the site of the suture line.

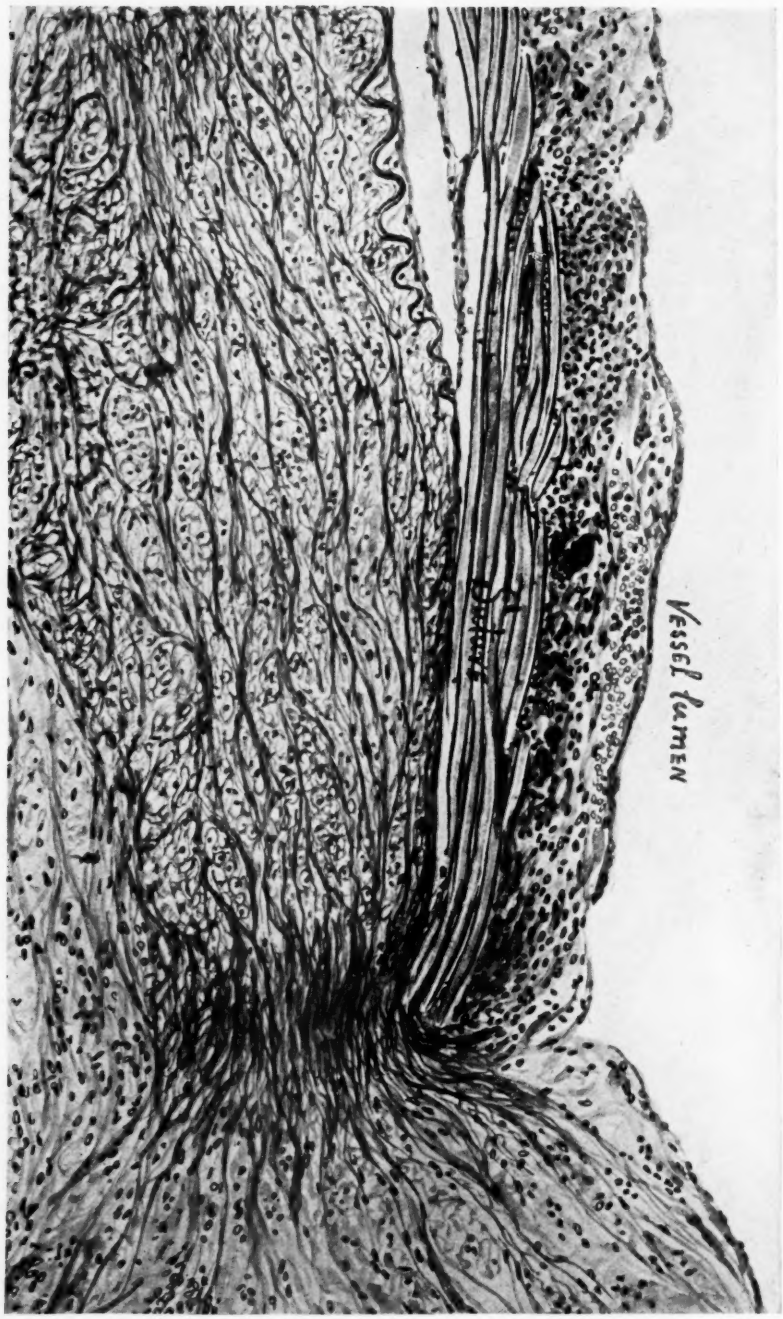


FIG. 3.—Drawing. End-to-end suture of carotid. Dog No. 27. Surg. Path. No. 3729. Operation November 13, 1915. Specimen removed November 22, 1915. Sutured ends separated by ½ mm. of connective tissue on one side; on the other side by 2 mm. This connective tissue at some points is dense; at other points it is loosely constructed. The intima regenerates everywhere. At one point, one of the sutures lies within the vessel lumen, and is completely covered by connective tissue, with an endothelial surface. Where there was wide separation of the vessel ends, there is a considerable mass of relatively loose connective tissue on the surface which is covered with intima. In the depths the repaired vessel wall is dense and suggests osteoid structures. In the depths of the suture line at another point, very definite osteoid structure exists. There is a distinct dilatation of the lumen present at the site of the suture line.

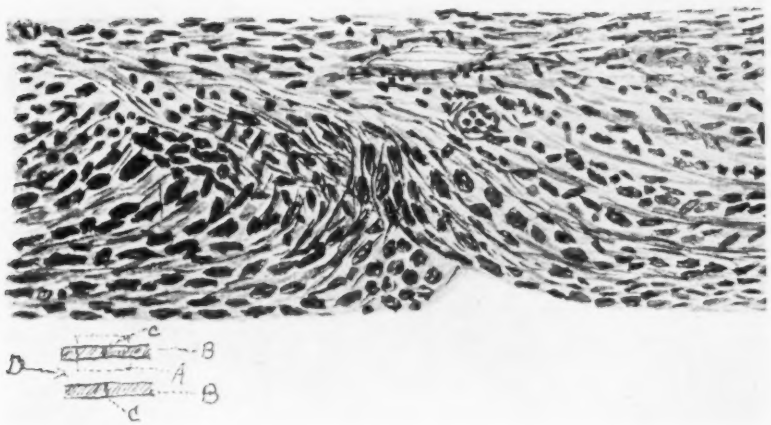
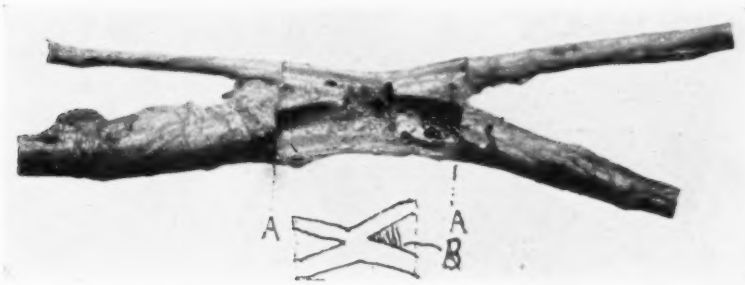


FIG. 4.—Drawing. End-to-end suture of carotids. Dog No. 108. Surg. Path. No. 3846. Operation January 20, 1916. Specimen removed February 9, 1916. Cicatricial tissue firmly unites one vessel end to that of the other. One extremity is slightly everted and the other is implanted upon it. The recess is so obliterated by connective tissue that the intimal lining is completely regenerated. The suture line is hardly discernible on account of the merging of the cicatrix with the sutured ends. Smooth muscle cells as demonstrated in a Van Gieson stain infiltrate the cicatrix.



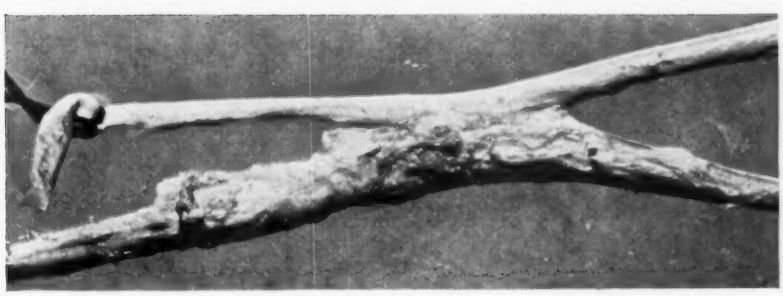


FIG. 5.—Side-to-side anastomosis, jugularis externa and carotid. Surg. Path. No. 3861. Operation June 18, 1915. Specimen removed February 28, 1916.

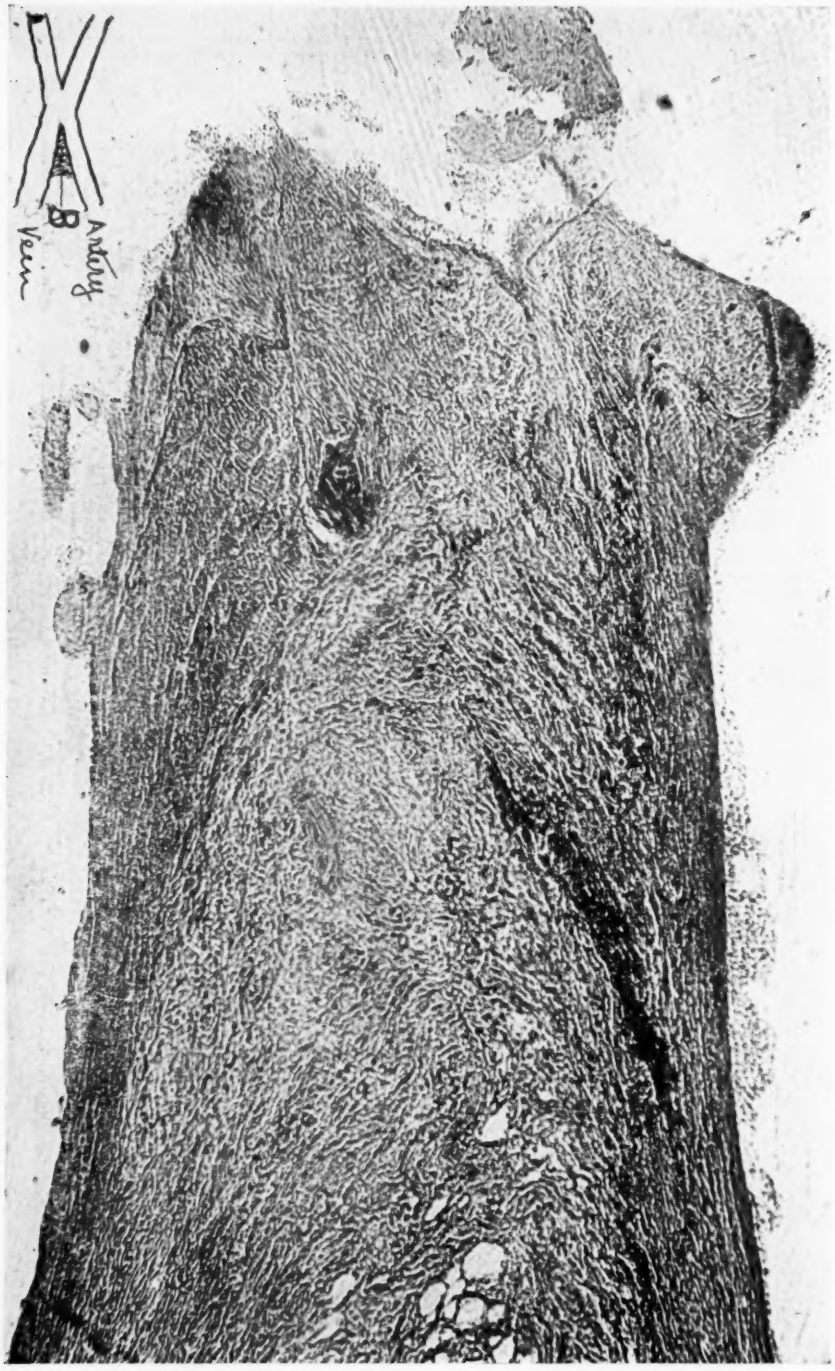


FIG. 6.—Photomicrograph. Side-to-side anastomosis between external jugular and carotid. Dog No. 386. Surg. Path. No. 3861. Operation June 18, 1915. Specimen removed February 28, 1916. Intimal surface joins intimal surface through the opening. Cicatricial tissue joins adventitia to adventitia adjacent to the opening. Sutures are well buried in the media and adventitia.

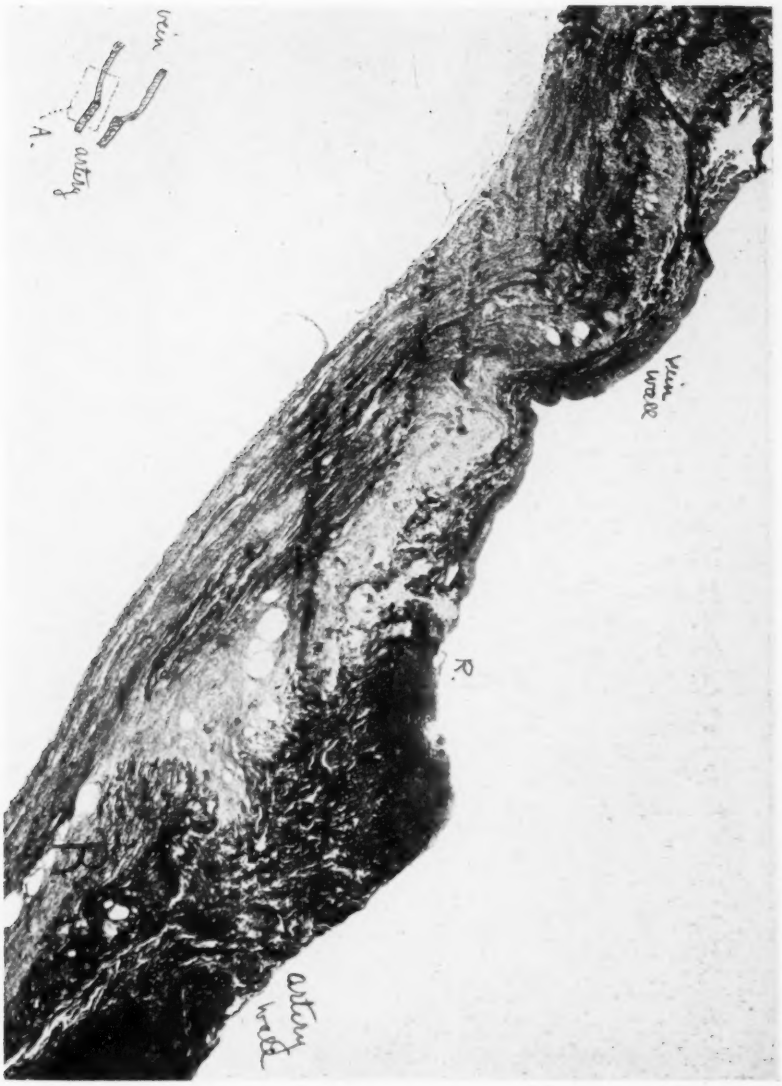


FIG. 7.—Photomicrograph, mag. 20. Autotransplantation of femoral vein to carotid. Eight days. Dog No. 268. Surg. Path. No. 2382. Space between artery wall and transplant is exceedingly small and made up of proliferating connective tissue. Surface of the transplant is undergoing some form of degeneration. Immediately beneath the wall of the transplant, active proliferation of connective tissue is seen. A suture in the intima is covered by fibrin and reparative connective-tissue cells. Elastic fibres in the transplant are separated into smaller bundles. The wall of the transplant is apparently undergoing degeneration.

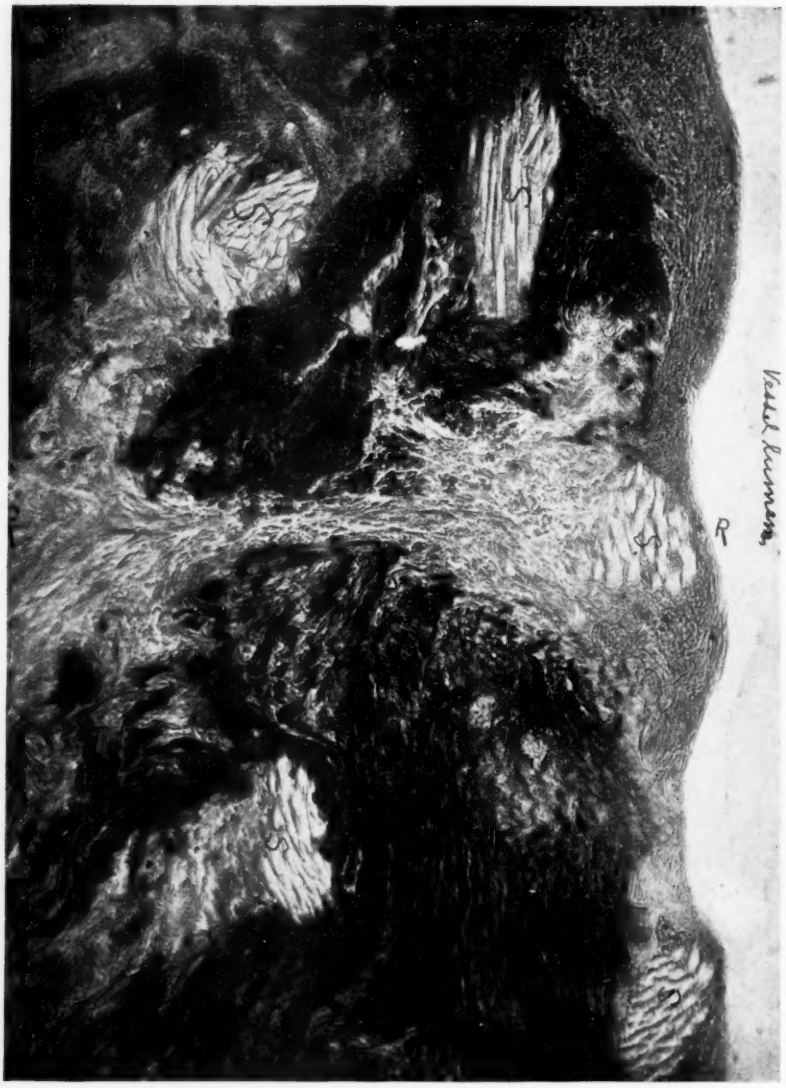


FIG. 8.—Photomicrograph, mag. 300. Autotransplantation of femoral vein to carotid. Eight days. Dog No. 268. Surg. Path. No. 2382. Space between artery wall and transplant is exceedingly small and made up of proliferating connective tissue. Surface of the transplant is undergoing some form of degeneration. Immediately beneath the wall of the transplant, active proliferation of connective tissue is seen. A suture in the intima is covered by fibrin and reparative connective-tissue cells. Elastic fibres in the transplant are separated into smaller bundles. The wall of the transplant is apparently undergoing degeneration.

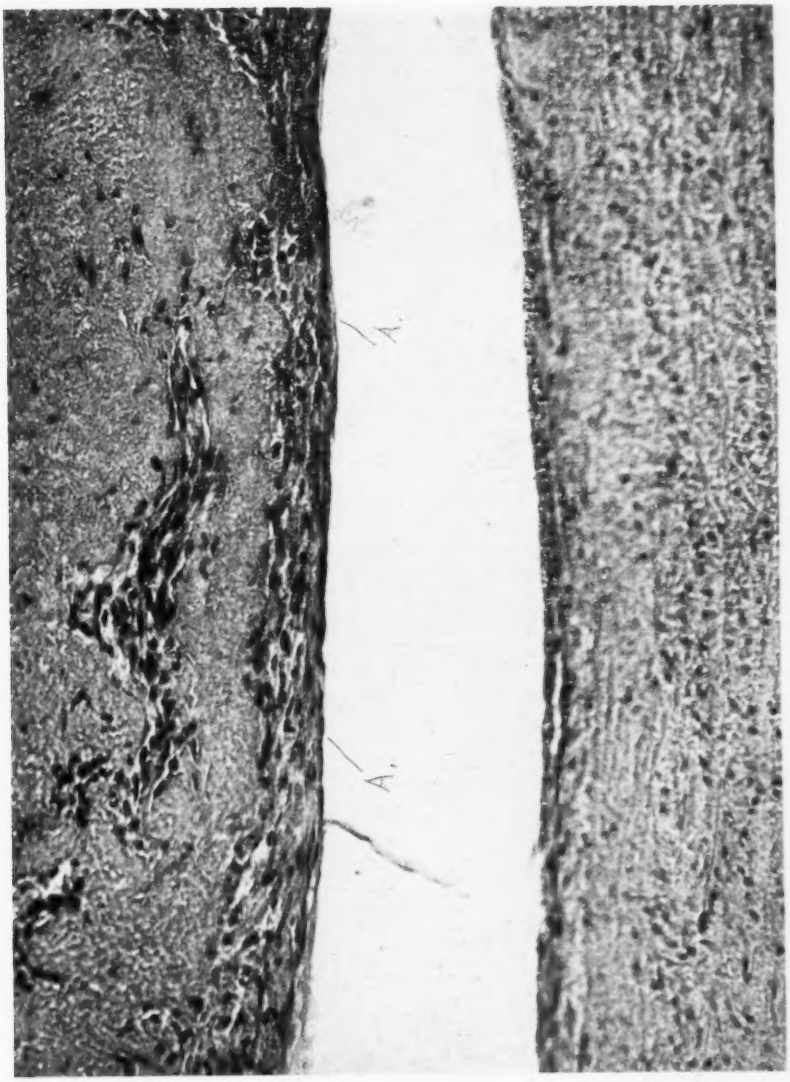


FIG. 9.—Photomicrograph, mag. 415. Autotransplantation of vein into carotid. Surg. Path. No. 2283. Operation January 3. Specimen removed January 17. Vessel partially occluded by coagulum. Surface of coagulum presents connective-tissue cells and apparently no accretion has taken place. Blood coagulum covered by growing fibroblasts also infiltrating coagulum. No further tendency for blood to form a clot in the coagulum which presents a smooth surface as shown here.

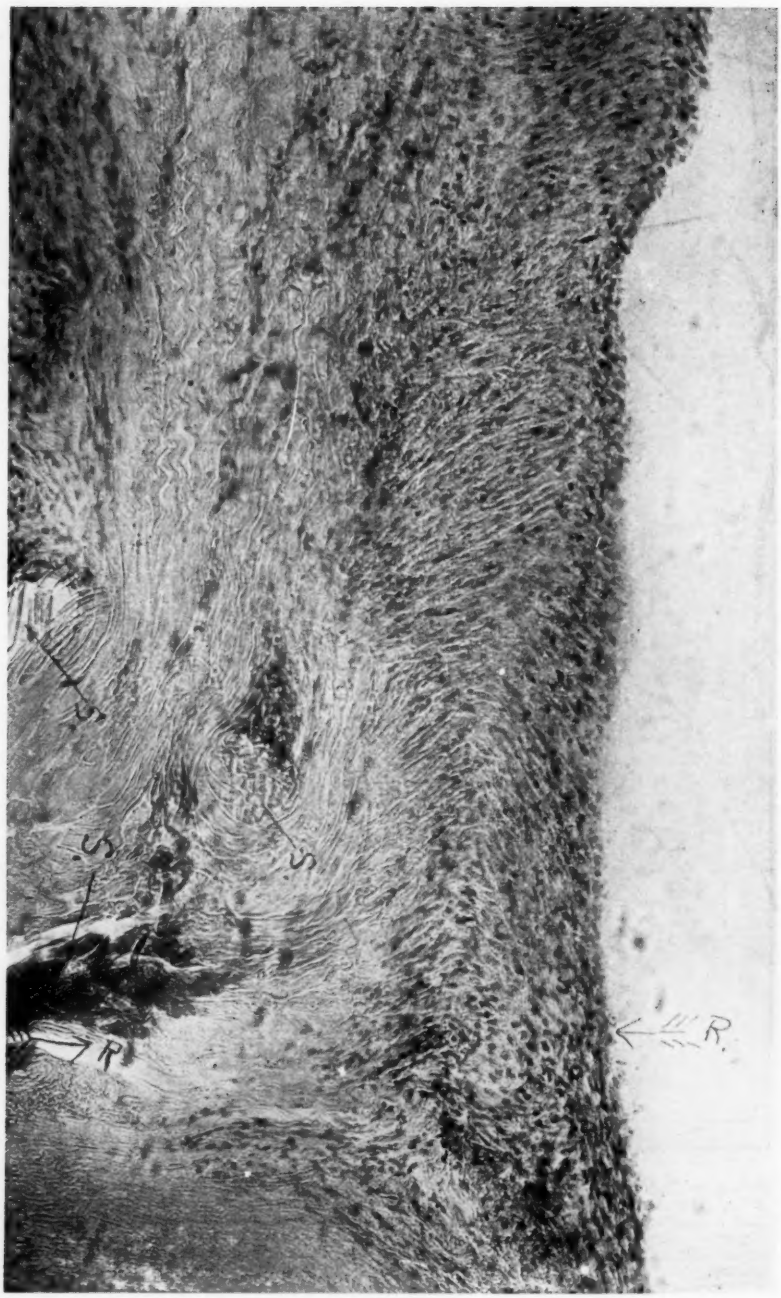


FIG. 10.—Photomicrograph, mag. 200. Autotransplantation of jugular to carotid. Two weeks. Dog No. 201. Surg. Path. No. 2340. Specimen removed January 31, 1913. Walls of the vessels are separated by about one millimetre. The interval is filled in by dense connective tissue. Scar tissue is somewhat irregular, but not covered by fibrin, except at one point. A uniform and regular layer of cells covers the cicatricial scar tissue.

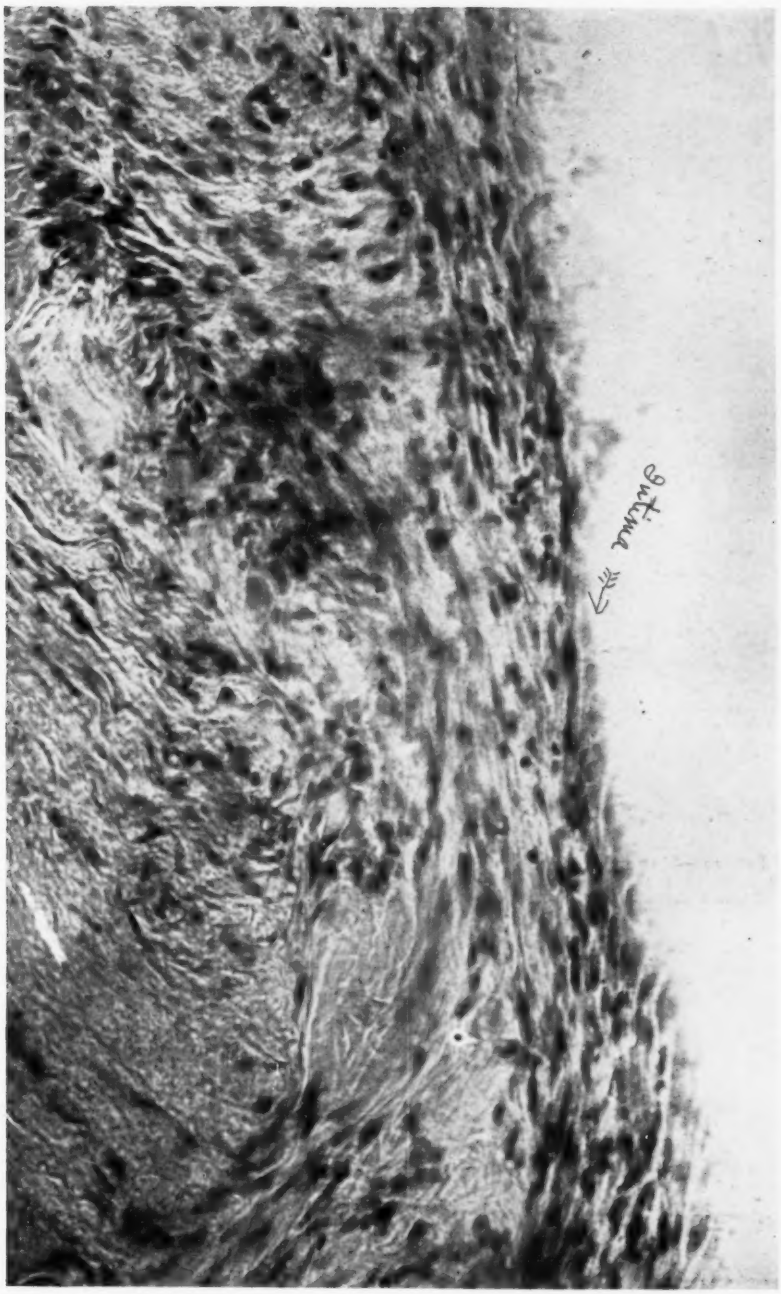


FIG. 11.—Photomicrograph, mag. 415. Autotransplantation of jugular to carotid. Two weeks. Dog No. 201. Surg. Path. No. 2340. Operation January 14, 1913. Specimen removed January 31, 1913. Walls of the vessels are separated by about one millimetre. The interval is filled in by dense connective tissue. Scar tissue is somewhat irregular but not covered by fibrin except at one point. A uniform and regular layer of cells covers the cicatricial scar tissue.

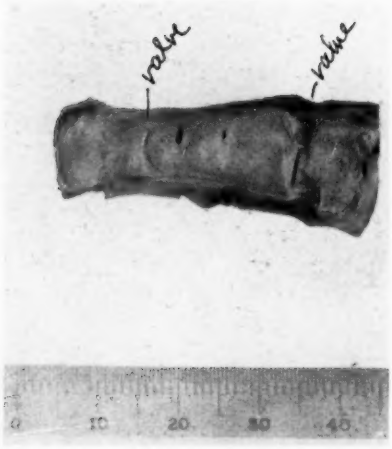


FIG. 12.—Homotransplantation of femoral vein to jugular vein. Surg. Path. No. 2477. Operation April 11, 1913. Specimen removed April 18, 1913. Shows two valves in transplanted vein, one of which encroaches upon suture line.

FIG. 13.—Photomicrograph. Homotransplantation of femoral vein to the jugular. Dog No. 346. Surg. Path. No. 2477. Femoral vein transplanted from donor 178. Operation April 11, 1913. Specimen removed April 18, 1913. Complete union between transplant and jugular. Sutures are *in situ*. Accumulation of leucocytes about sutures. Intima smooth and even throughout. No formation of fibrin on intimal surface. Minute amount of connective tissue between apposed ends of vessels.

FIG. 14.—Arteriovenous anastomosis of femoral vessels. Male adult, aged thirty-five. Surg. Path. No. 3550.

FIG. 15.—Photomicrograph, mag. 100. Arteriovenous anastomosis (human vessels). Surg. Path. No. 3550. The artery in close apposition with vein, especially in adventitia and media. Mass of connective tissue which has grown beneath the intima reinforces the junction. In the section at points the endothelium is intact. A thin layer of fibrin with a few round-cells in it is in the venous portion of the section.

Experiment No. 35.—Fig. 5. Side-to-side anastomosis. Jugularis externa and carotid. Surg. Path. No. 3861. Operation June 18, 1915. Specimen removed February 28, 1916.

Fig. 6. Photomicrograph. Side-to-side anastomosis between external jugular and carotid. Dog No. 386. Surg. Path. No. 3861. Operation June 18, 1915. Specimen removed February 28, 1916. Intimal surface joins intimal surface through the opening. Cicatricial tissue joins adventitia to adventitia adjacent to the opening. Sutures are well buried in the media and adventitia.

Experiment No. 12.—Fig. 7. Photomicrograph. Mag. 20. Autotransplant of femoral vein to carotid. Eight days. Dog No. 268. Surg. Path. No. 2382. Space between artery wall and transplant is exceedingly small and made up of proliferating connective tissue. Surface of the transplant is undergoing some form of degeneration. Immediately beneath the wall of the transplant, active proliferation of connective tissue is seen. A suture in the intima is covered by fibrin and reparative connective tissue cells. Elastic fibres in the transplant are separated into smaller bundles. The wall of the transplant is apparently undergoing degeneration.

Fig. 8. Photomicrograph. Mag. 300. Autotransplantation of femoral vein to carotid. Eight days. Dog No. 268. Surg. Path. No. 2382. Space between artery wall and transplant is exceedingly small and made up of proliferating connective tissue. Surface of the transplant is undergoing some form of degeneration. Immediately beneath the wall of the transplant, active proliferation of connective tissue is seen. A suture in the intima is covered by fibrin and reparative connective tissue cells. Elastic fibres in the transplant are separated into smaller bundles. The wall of the transplant is apparently undergoing degeneration.

Experiment No. 5.—Fig. 9. Photomicrograph. Mag. 415. Autotransplantation of vein into carotid. Surg. Path. No. 2283. Operation January 3. Specimen removed January 17. Vessel partially occluded by coagulum. Surface of coagulum presents connective tissue cells and apparently no accretion has taken place. Blood coagulum covered by growing fibroblasts also infiltrating coagulum. No further tendency for blood to form a clot in the coagulum which presents a smooth surface as shown here.

Experiment No. 7.—Fig. 10. Photomicrograph. Mag. 200. Autotransplantation of jugular to carotid. Two weeks. Dog No. 201. Surg. Path. No. 2340. Specimen removed January 31, 1913. Walls of the vessels are separated by about one millimetre. The interval is filled in by dense connective tissue. Scar tissue is somewhat irregular, but not covered by fibrin, except at one point. A uniform and regular layer of cells covers the cicatricial scar tissue.

Fig. 11. Photomicrograph. Mag. 415. Autotransplantation of jugular to carotid. Two weeks. Dog No. 201. Surg. Path. No. 2340. Operation, January 14, 1913. Specimen removed January 31, 1913. Walls of the vessels are separated by about one millimetre. The interval is filled in by dense connective tissue. Scar tissue is somewhat irregular but not covered by fibrin except at one point. A uniform and regular layer of cells covers the cicatricial scar tissue.

Experiment No. 11.—Fig. 12. Homotransplantation of femoral vein to jugular vein. Surg. Path. No. 2477. Operation April 11, 1913. Specimen removed April 18, 1913. Shows two valves in transplanted vein, one of which encroaches upon the suture line.

Fig. 13. Photomicrograph. Homotransplantation of femoral vein to the

jugular. Dog No. 346. Surg. Path. No. 2477. Femoral vein transplanted from donor 178. Operation April 11, 1913. Specimen removed April 18, 1913. Complete union between transplant and jugular. Sutures are *in situ*. Accumulation of leucocytes about sutures. Intima smooth and even throughout. No formation of fibrin on intimal surface. Minute amount of connective tissue between apposed ends of vessels.

Case No. 11.—Fig. 14. Arteriovenous anastomosis of femoral vessels. Male adult, age thirty-five. Surg. Path. No. 3550.

Fig. 15. Photomicrograph. Mag. 100. Arteriovenous anastomosis (human vessels). Surg. Path. No. 3550. The artery in close apposition with vein, especially in adventitia and media. Mass of connective tissue which has grown beneath the intima reinforces the junction. In the section at points, the endothelium is intact. A thin layer of fibrin with a few round-cells in it is in the venous portion of the section.

Experiment No. 14.—Homotransplantation of femoral artery to carotid. Dog No. 325 and Dog No. 294. Surg. Path. No. 2753. Shows a nice apposition of vessel ends with a minimum of cicatricial tissue with complete regeneration of intima. Operation March 7, 1913. Specimen removed March 21, 1913.

Experiment No. 30.—Homotransplantation of carotid. Three weeks. Dog No. 223 and Dog. No. 224. Surg. Path. No. 3529. Transplanted portion is undergoing degeneration though the coil of elastic lamina is still present but becoming fragmented. Elastic fibres can be seen in the degenerating portion. Beneath the adventitia of the transplant connective tissue is growing and infiltrating the adventitia. A minimum amount of cicatrix between transplant and original artery. Intima is intact. No functionating blood-vessels present in the transplant.

Experiment No. 50.—Homotransplantation of carotid to carotid. Surg. Path. No. 3526. Intima line of suture shows small dimple. Just beneath the lining cells a suture. Muscularis thrown up into a tent-like fold. In the connective tissue, outside of the muscularis several small deposits of chalk are seen. The adventitial line of suture shows considerable old blood pigment, several small round-cells and fibroblasts. No evidence of real bone formation.

Experiment No. 53.—Homotransplantation of carotid to carotid. Surg. Path. No. 3527. At the intimal side of suture line is thrown up a fibrinous plastic deposit. Muscularis on either side separated by considerable fibrous tissue. Suture line very irregular and shows much more connective tissue production than the others.

Experiment No. 56.—Homotransplantation of carotid to carotid. Surg. Path. No. 3528. Suture line shows usual indentation which is partially filled up by fibrin and blood clot. Just beneath this are seen large irregular masses of calcium. Beneath this the muscularis is apparently continuous. No break in the muscularis or evidence of fibrous union.

There is more or less unanimity of opinion in the manner of restoration of all the coats of the vessel excepting of the intima. Some believe that the surface connective tissue cells become adapted and form the lining endothelium, while the majority believe that the undamaged adjacent endothelial proliferation should cover the exposed connective tissue.

This latter conception is in accordance with the uniformly accepted

interpretation of the repair and regeneration of epithelial defects in the skin and in the mucosæ where epithelium proliferates from the margins and covers the denuded area. It seems to be a question of specificity; of the epithelium it is recognized; of the endothelium, it is questioned.

H. von Schulte after extensive and exhaustive studies on the early stages of vasculogenesis in the cat makes deductions which seem to cast doubt upon the specificity of endothelium. He believes that endothelium may be adapted from connective tissue cells.

The recent studies of W. C. Clarke lend support to his deductions. Clarke holds that the following hypothesis premised in his article is tenable, that is, the surface cells of serous membranes and those lining blood-vessels may regenerate from deep connective tissue cells, and do not necessarily arise from adjacent intact mesothelial or endothelial cells.

Histological studies tend to demonstrate that in the absence of infection, even if the lines of the vessels are not evenly approximated, the chink will be filled in with blood clot. As long as this minute blood clot does not project into the lumen of the vessel there is no accretion and it does no harm. Fibrous connective tissue will grow in and organize the blood clot, and the cells which finally reach the surface will become competent as endothelial cells. In other words, a foreign body in blood-vessels, such as a suture if it is not contaminated, will not produce thrombosis. This may be observed in No. 3729, Fig. 3.

The following conclusions are the result of these studies:

The continuous circular suture with fine silk (vaselined or paraffined) penetrating the media and intima is thoroughly practicable and of ready application.

The circular suture restores the continuity of the vessel without impairing the integrity of its walls or diminishing its lumen.

Side-to-side anastomosis between an artery and a vein can be readily accomplished without the formation of thrombosis.

Fusion of the approximated ends of the vessels takes place by connective-tissue proliferation.

A slight bulging at the suture line does not seem in any way to interfere with the functional efficiency of the vessel, as is shown in two of the specimens.

In the absence of infection, sutures penetrating the intima and entering the lumen of the vessel will do no harm. Connective tissue will grow in and cover the sutures. The cells covering the suture line may become flattened and fuctionate eventually as endothelial cells, or, as many believe, the connective tissue is covered by proliferating endothelium.

In end-to-end anastomosis, by the introduction of one retaining

suture posteriorly, a minimum amount of twisting of the vessels is brought about. This has been found of special importance in the suture of a shorter vessel (splenic and renal).

Autotransplantation and homotransplantation of segments of veins and arteries are perfectly practicable. While a tendency to degeneration of the transplant is indicated, the functional results of the transplant do not seem to be impaired.

In my opinion all transplanted tissue that degenerates sooner or later undergoes connective tissue infiltration, and becomes replaced by the tissue of the host. The transplant acts as a scaffold for the support of the connective tissue of the host.

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STUDIES IN REGENERATION AND GROWTH OF BONE*

THE DEMONSTRATION OF NEW FORMED BONE BY INTRAVITAL STAINING

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The accurate knowledge of the process of growth and regeneration of bone is of very great importance in the treatment of all diseases of bones and especially in those conditions in which plastic bone surgery is indicated. A large amount of experimental work has been done on this subject and there is yet a difference of opinion concerning the osteogenetic properties of the different elements of bone. This is especially true as regards the osteogenetic properties of the different elements of the free bone transplant.

This difference of opinion may be due to the unsatisfactory methods which have been used in experimental study. Examination of the specimens from experiments by dissection or by means of the Röntgen rays does not reveal small changes. Microscopic study is unsatisfactory because it is often impossible to distinguish between the process of new bone formation and the process of bone absorption. A method which would make it possible for the investigator to distinguish the new bone which has formed in any given length of time would be valuable in the study of many of the problems of the growth and regeneration of bone.

In 1736 John Belchier,[1] an English surgeon, called attention to the fact that the bones of animals which had been fed on madder root (*Rubia tinctorum*) were colored red. Beckman[2] cited evidence that this fact was probably known to the ancients. During the period 1739 to 1760, several investigators, du Hamel,[3] Haller,[4] Bordenave,[5] Fougeroux,[6] Dethlef,[7] and others used this method in many experiments to study the growth and regeneration of bones, and recorded much fundamental knowledge, full credit for which is not found in modern literature. All of these investigators knew that it was only the bone which was formed during the ingestion of the madder which was colored,

* Read before the Washington University Society, January 8, 1917.

FIG. 1

FIG. 2

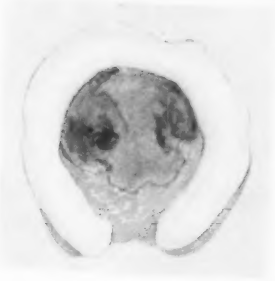

FIG. 3

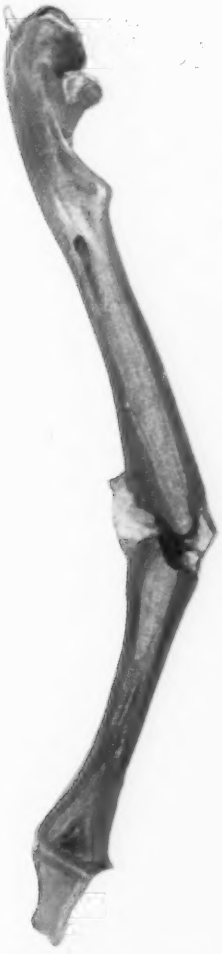

FIG. 1.—Experiment No. 1. Femur of a dog. Strip of bone was removed. The animal was then fed madder for seventeen days. Note the pink color to the new bone formed in the defect and about its margin.

FIG. 2.—Experiment No. 1. Cross-section of femur shown in Fig. 1.

FIG. 3.—Experiment No. 2. Ulna of rabbit fourteen days after fracture. Animal fed sodium alizarine sulphonate. Note the new bone formed in the callus and along the shaft is colored red. The original bone shaft and the cartilaginous portion of the callus are unstained.

but it was James Paget [8] who first emphasized this point. This author writes of experiments with madder:

"Experiments with madder root afford the observer a means, as it were, of branding with his own mark every particle of phosphate of lime deposited in a given time."

Kölliker,[9] Strelzoff,[10] and Ollier [11] used madder to color bones in living animals, but this method has not been used in any of the recent experimental work. Shipley and Macklin [12] briefly describe the use of trypan blue as a method of staining areas of "osteoblastic activity." The color bearing substance of madder is a glucoside of alizarine, and alizarine has been used by Spalteholz as a post-mortem stain for bone.

The following experiments were done in order to test the properties of madder root, alizarine, and sodium alizarine sulphonate as regards vital staining of bone. The animals used were dogs and rabbits. All operations were done with complete ether anæsthesia and open operations were done with the usual precautions against wound infection.

I. EXPERIMENT WITH MADDER

The substance used was "Dutch madder," and was said to be the madder root dried and ground. It was a fine red powder.

Experiment No. 1.—November 6, 1916. Adult dog. Weight, 10 K.

Ether anæsthesia. Shaft of femur exposed. With a motor saw, a strip of bone 2 mm. wide and 4 cm. long was excised from the full thickness of the cortex of the shaft of the femur. Wound closed.

The animal was fed 20 grammes of powdered madder root daily in a thick soup with meat, for seventeen days.

November 23, 1916. Animal sacrificed. The femur from which the strip of bone was excised shows the defect filled with new formed bone. There is an area of subperiosteal new bone about the margins of the defect. The new formed bone which has filled the defect and that formed under the periosteum about the margins of the defect is a pale rose pink color. The remainder of the bone and the other bones in the body are normal in color (see Fig. 1). On cross-section of the femur the differentiation of the new formed bone is even more striking (see Fig. 2).

This experiment confirms the observations of the previous investigators on the results of feeding madder to animals with growing bone tissue. The bone which formed during the ingestion of the dye was stained and that which had been previously formed preserved its normal color. The color obtained in our experiments was quite faint. This may be due to the inferior quality of the madder root or the small

amount given. The method was discontinued on account of much more satisfactory results being obtained by the use of sodium alizarine sulphonate.

2. EXPERIMENTS WITH ALIZARINE AND SODIUM ALIZARINE SULPHONATE

As previously stated, the color bearing substance in madder is a derivative of alizarine. Alizarine was tried in a single experiment in which it was fed to a rabbit with an experimental fracture for a period of eleven days. The new bone formed was not colored. Alizarine is a very insoluble substance and it may be that it is not absorbed from the intestinal canal. The soluble alizarine derivative, sodium alizarine sulphonate, was used in the following experiments:

Experiment No. 2.—October 30, 1916. Rabbit.

Ether anæsthesia. Both bones of the left foreleg fractured. The animal was fed on a mixture of rolled oats and sodium alizarine sulphonate. To each 100 grammes of rolled oats was added 5 grammes sodium alizarine sulphonate. A constant supply of the mixture was kept in the animal's cage. Owing to frequent soiling of the food supply, the actual amount of the dye ingested was not determined.

November 13, 1916. Fourteen days. The animal remained in good condition. Sacrificed.

Autopsy.—The bones other than those of the left foreleg appeared quite normal. The fractured bones were firmly united by callus. The entire shafts of both bones from the exterior were colored dark red. The callus immediately at the fracture was mottled red and white. On section of the bones the red color was confined to a layer of new formed bone under the periosteum and to the ossified areas in the cartilaginous callus. The original shafts of the bones and the cartilaginous portion of the callus were normal color (see Fig. 3).

Experiment No. 3.—November 14, 1916. Rabbit.

Ether anæsthesia. Both bones of right foreleg fractured. Animal given daily 1 c.c. of one-half saturated aqueous solution sodium alizarine sulphonate, subcutaneously.

November 23, 1916. Nine days. Animal in good condition. Slight induration about some points of subcutaneous injection. Sacrificed.

Autopsy.—The bones of the extremities were removed and cleaned partially of soft parts and placed in formalin. When the color due to blood had faded, the bones were cleaned. The bones other than those fractured were normal in appearance. The fractured bones were united by firm callus. The entire shafts of both bones were a bright violet-red color on the outside surfaces. The callus was partially ossified. The ossified areas were stained. The cartilage was unstained. On section of the bones the color was confined to a layer of new bone formed under the periosteum. The original shafts of the bones were unstained. In the callus were fragments of bone. These fragments were unstained, but the new bone formed about the fragments was colored (see Fig. 4).

FIG. 4

FIG. 5

FIG. 4.—Experiment No. 3. Radius of rabbit nine days after fracture, and the radius of the opposite side. Animal given sodium alizarine sulphonate subcutaneously. Note the new bone formed along the shaft and from the bone fragment in the callus is colored. The radius of uninjured leg is unstained.

FIG. 5.—Experiment No. 5. Bones of foreleg of young rabbit sixteen days after subperiosteal resection of a portion of the ulna. Animal given sodium alizarine sulphonate subcutaneously. Note the red color of the new bone formed in the defect and the coloring of the bone at the epiphysial cartilages.

Experiment No. 4.—November 14, 1916. Rabbit.

Ether anæsthesia. Both bones of right foreleg fractured. Animal given 1 c.c. of a saturated aqueous solution of sodium alizarine sulphonate intravenously in marginal ear vein. The injection was repeated on the two following days.

November 17, 1916. Animal found dead.

Autopsy.—The bones of the extremities were removed. No visible coloring of exterior of bones. No callus at site of fracture. No evidence of new bone formation. No color. The bones were placed in formalin and when sectioned a few days later, there was seen a faint pink in the marrow canal. This coloring was probably due to post-mortem staining of the bone from the dye in the blood serum. No color observed where the soft parts were not left in contact with the bone.

Experiment No. 5.—November 25, 1916. Rabbit.

Ether anæsthesia. Incision in foreleg. Subperiosteal resection of 1 cm. of ulna. Wound closed.

November 29, 1916. Animal given 1 c.c. saturated aqueous sodium sulphonate intravenously.

December 11, 1916. Sixteen days. Animal has had daily 2 c.c. saturated aqueous solution sodium alizarine sulphonate subcutaneously. Sacrificed.

Autopsy.—There was regeneration of a bone bridge across the defect in the resected ulna. The bone filling the defect was stained a deep violet red color. There was subperiosteal new bone formation along the shaft of the stump of the ulna. There was some new bone formation on the radius in the region of the resection of the ulna. All new formed bone was deeply stained. The preformed bone was unstained. The other bones of the extremities showed an irregular mottling of the outside surfaces of the shafts. There was a thin layer of color irregularly distributed on the wall of the medullary canal. At the epiphysial lines there was very marked staining. There was a very narrow line of color on the epiphysial side of the cartilage and wider deeper stained zone on the diaphysial side. The epiphysis showed only slight coloring (see Fig. 5).

Experiment No. 6.—November 20, 1916. Dog.

A young dog was given daily a subcutaneous injection of 2 c.c. of a saturated aqueous solution of sodium alizarine sulphonate for seven days. The injection of the dye resulted in the formation of several subcutaneous abscesses, and the animal lost considerable weight during the experiment. On examination of the bones it was found that the epiphyses were not united to the shafts. A description of the coloring of the radius and ulna will exemplify the coloring of all the bones in the body. The shafts of the bones were faintly stained on the external surface. The color was more marked near the epiphysial lines. On section of the bones, the color was confined to a thin layer of bone next to the periosteum. The remainder of the thickness of the bone was unstained. There was a marked zone of color on the diaphysial side of each epiphysial cartilage of the radius and on the diaphysial side of the distal epiphysial cartilage of the ulna (see Fig. 6). This is of particular significance when it is appreciated that the length of the forearm is increased by the growth of bone at both epiphysial lines in the radius, while the ulna can increase the length of the forearm only from growth at the distal epiphysial line, since the joint

intervenes between the proximal epiphysial line and the shaft. The styloid process of the ulna was colored at the tip. The epiphyses were otherwise uncolored.

Experiment No. 7.—December 19, 1916. Rabbit.

Ether anæsthesia. Fracture of the right ulna. The animal was allowed to live for thirteen days; no sodium alizarine sulphonate being given. On the beginning of the fourteenth day, 5 c.c. of a saturated aqueous solution of sodium alizarine sulphonate was given subcutaneously. The animal was sacrificed on the following day.

Examination of the bones showed a narrow zone of color on the diaphysial sides of the epiphysial cartilages. The fractured bone fragments were united by a firm callus which was almost completely ossified. The new formed bone of the callus was colored irregularly. The new bone at the junction of the callus and the shaft was colored very faintly or not at all. The new bone in the middle of the callus was vividly stained. The bone which was not stained was at the site where new bone is first formed (see Fig. 7). The remainder of the bone and the other bones of the body were normal in color except at the epiphysial lines.

These experiments show that sodium alizarine sulphonate, when given by mouth, subcutaneously, or intravenously, has selective intravital staining properties for new formed bone. In Experiment No. 4, in which large doses of the dye were given intravenously to an adult rabbit for three days, there was no staining of the bones during life. In Experiments Nos. 2 and 3, it was only the new bone formed in response to injury which was colored. In Experiment No. 6, in which there was no injury, there was staining of the bone at the sites at which the normal growth of bone occurs. In Experiment No. 5, the new bone formed in response to injury and that formed in the normal growth of the animal was colored.

Experiment No. 7 is particularly interesting. It shows that it is not only the bone which is actually formed during the time the dye is in the circulation which is stained, but that also the bone which has been recently laid down is colored. The formation of new bone in experimental fractures in rabbits begins about the fourth day. In this experiment the new bone formed during the first few days of actual bone production remained uncolored. It would seem, therefore, that a single injection of the dye would stain all new bone formed in response to injury, during a period approximately a week previous to the injection. Further investigation is needed to substantiate this conclusion, but, in other experiments, injection of the dye once each week has seemed to color all the new bone formed during periods as long as a month. This experiment indicates that the statement of Paget, that madder stains only bone which is formed during the period

FIG. 6 FIG. 7

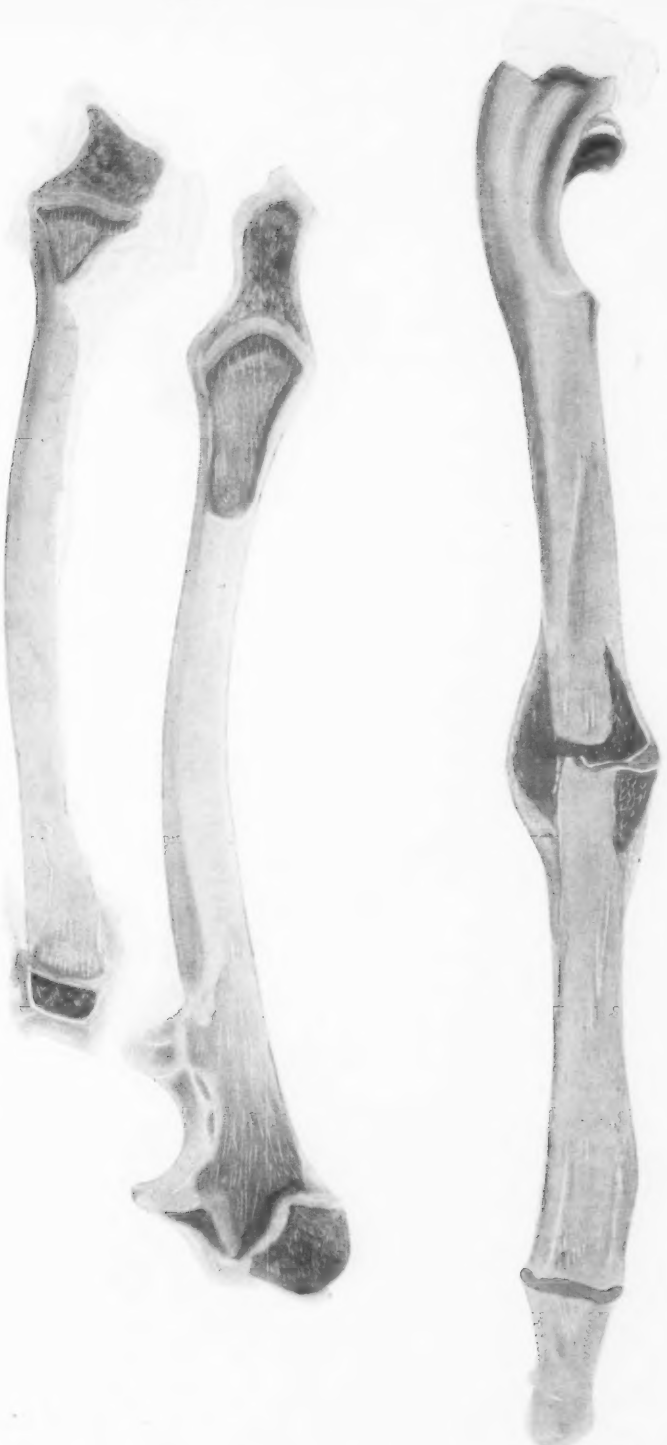

FIG. 6.—Experiment No. 6. Radius and ulna of a young dog. Sodium alizarine sulphonate given subcutaneously seven days. Note the coloring of bone at both epiphysial lines of radius and at only the distal epiphysial line of the ulna.

FIG. 7.—Experiment No. 7. Ulna of rabbit fourteen days after fracture. Single subcutaneous injection of sodium alizarine sulphonate on fourteenth day. Note staining of new bone in callus. The bone formed at X is uncolored.

in which the dye is given, could not be applied absolutely to the use of sodium alizarine sulphonate.

In Experiment No. 6, it was found that the subcutaneous injection of the saturated solution of the dye led to the formation of abscesses at the site of injection. This has occurred in all cases in which dogs have been given the dye subcutaneously. It has not occurred in similar administration to rabbits. In later experiments with dogs more satisfactory results have been obtained by using a more dilute solution and injecting it intraperitoneally. It has also been found that feeding sodium alizarine sulphonate to dogs has resulted in relatively faint staining of the bone, while the same method of administration to rabbits has stained the new formed bone very vividly. It is interesting that the color obtained in the new formed bone in those cases in which the dye was given by mouth was different from that seen in the new bone formed during the administration of the dye subcutaneously. In the former case the color is a brick red; in the latter, a violet-red.

The color in the new bone tissue is more striking after the tissue has been in formalin for twenty-four hours, and the normal blood color of the tissues has faded. The colored bone tissue fades slowly in formalin but rapidly when the specimen is allowed to dry. The color is entirely removed when the bone is decalcified. The color in the bone is probably due to a chemical combination between the dye and the calcium salts of the bone. In one experiment in which the dye was being given there was degeneration and calcification of muscle. The calcified areas in the muscle were colored red. No other tissue in the body has been observed to be stained. The selection of the dye for new formed bone must be due to the fact that the calcium salts in new formed bone are in such a state that chemical combination between the calcium salts and the dye can take place. Whether the calcium salts in bone which has been deposited for a longer time are prevented from combination with the color-bearing substance in the blood stream by being surrounded by impermeable material or whether the fully developed bone tissue does not color because the calcium salts in such tissue are in such chemical state that combination with the dye does not take place, is not clear. That it is not merely a matter of vascularity is shown by the fact that cancellous bone does not stain any more readily than dense cortical bone. That the combination with the dye does take place even after the calcium salts have been taken out of the blood stream is shown by Experiment No. 7, in which there was staining of bone tissue formed previous to the injection of the dye.

The results of the application of this method of study of the osteo-

genetic properties of the free bone transplant will be reported in a later paper.

These experiments show that sodium alizarine sulphonate when given by mouth, subcutaneously or intravenously has selective intravital staining properties, and that it stains only bone which has been but recently formed or is formed during the period the dye is in the circulation.

The use of sodium alizarine sulphonate experimentally furnishes a valuable method in the study of the problems of regeneration and growth of bone.

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CONGENITAL LIPOMATA OF THE CHEEK

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Congenital tumors in the restricted use of the word are rare, and rarest of them all are the lipomata. In 1884, Jacobi [1] collected twenty-nine cases of the latter from the literature extending over a century. Many of the cases were not clean lipomata, but associated with lymphectasis, causing a localized gigantism. There must also be excluded from the congenital lipomata those cases in which the lipoma is only an addendum to some congenital deformity like spina bifida, with which it is not infrequently associated, or with the various teratomata as they occur, chiefly about the sacrum and coccyx. Morestin,[2] in reporting a congenital lipoma of the calf, quotes a thesis of Malacon, who was enabled to collect only twelve examples of congenital lipoma.

Of seventy-three cases of lipoma observed by Billroth,[3] in Zurich and Vienna, only one was congenital. It was on the dorsum of the foot. Lipomata of the cheek have been described by a number of authors, but very few have been seen sufficiently early in life to be indubitably congenital.

Perhaps the most interesting subject connected with fatty tumors of the cheek is the history of our knowledge of a little mass of fat, situated on and adherent to the outer surface of the buccinator muscle. It exists before birth and continues throughout life, and does not disappear even in extreme emaciation. Since from its function it may properly be called the sucking cushion or pad, it may be considered an anatomic proof that man never ceases to be a sucker, no matter what his age.

English and German anatomies refer but briefly to this fat pad. Like so many other things in medicine it was discovered and forgotten a number of times. It is probable that it was first recognized as a distinct entity by Heister,[4] in 1732, who described its shape and relations very accurately, but believed it to be of a glandular nature, probably on account of its proximity to the molar muciparous glands. Fig. 1 is a reproduction of Heister's copperplate of the fat pad, and Fig. 2, likewise reproduced from the original engraving of Heister, shows the lobulated contour of the fat pad, which doubtless led him to believe it to be of glandular origin. This figure is particularly interesting, in that it apparently shows two lobules into which the fat mass is often divided by the passage of the terminal part of the parotid duct.

Thirty years after Heister, Winslow [5] fell into the same error, but stated that one might easily mistake the glands for little fat masses. It remained for Bichat,[6] in his general anatomy of 1801, to finally recognize this pad as consisting of adipose tissue, which has ever since been recognized by French anatomists as *la boule graisseuse de Bichat.*

Probably Tillaux,[7] better than any regional anatomist, has depicted in the clearest way (Fig. 3) this fat pad, which he described as follows: Between the buccinator muscle and its aponeurosis there is a constant fat ball, even in the most emaciated subjects. It corresponds to the anterior border of the ascending ramus of the jaw, in relation with the anterior border, and a little on the inner surface of the masseter muscle, which it separates from the buccinator. The cheek presents therefore two layers of fat, which are distinct from each other. The one superficial, subcutaneous above the fascia, the other deep seated and beneath the fascia. The first layer is continuous with the subcutaneous adipose tissue of the temporal and parotid regions. The second is continuous with the fat of the zygomatic fossa, and through it with the subaponeurotic layer of the temporal region and of the floor of the parotid niche. In many subjects this little ball of fat is loosely surrounded by a thin capsule, through which it can be, as Bichat first showed, lifted out of the pocket in which it is contained.

A very interesting study of this little fat mass was made by Ranke,[8] who discovered it already well formed in the fœtus as early as the fourth month. He recognized its covering with the special capsule and described particularly a prolongation, likewise covered by a capsule, which is projected into the sphenopalatine fossa, and gives at times a prediverticulated appearance to the little ball of fat. All writers agree that the suction pad is separate and distinct from the general subcutaneous adipose layer.

In 1853, Gehewe,[9] in a long forgotten thesis, came to the conclusion that the function of this fat pad differs from that of fat in general, and believed that in a mechanical way it aided the act of sucking, in that, since the buccinator muscle in the new-born is still very feeble, the fat pad by its outer attachments prevents the indrawing of the cheek while nursing.

Fatty tumors of the cheek were, so far as I know, first mentioned by Bruns,[10] who collected four cases. He called attention to the ease with which the growth might be mistaken for a parotid tumor. Two cases of lipoma of the cheek are contained in the statistics of Stoll,[11] one of which probably sprang from the fat pad under consideration. A case was reported by Villars [12] to the French Academy in 1888, and in his

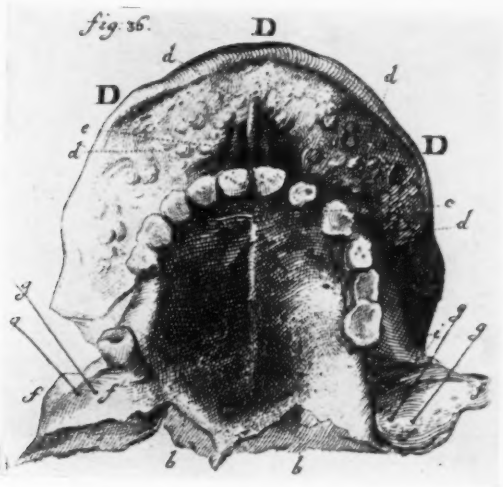

FIG. 1.—gg, fat pad.

FIG. 2.

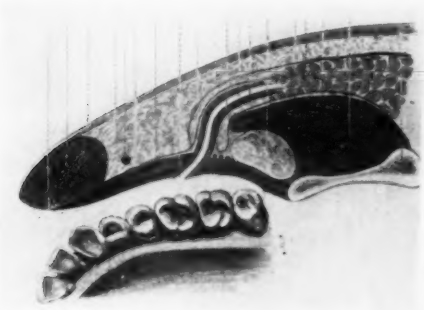

FIG. 3.

FIG. 4.

FIG. 5.

article he refers to ten other lipomata of the face, the descriptions of which, however, are very brief, and it must be questioned whether they belong to the deep-seated group springing from the fat pad of Bichat. None of these cases were distinctly congenital.

Virchow [13] in his classic work on tumors refers to a single example contained in his collection. Gant [14] and Mathias [15] have reported cases in the *Lancet*. They are the only cases which I have been enabled to find in the English literature. I am perhaps fortunate, therefore, in being enabled to present two cases, congenital in nature, that have been under my care, with an interval of over twenty years between them.

The first was a little girl of six months (Fig. 4), who from the time of her birth had a large swelling of the left cheek, which grew rather rapidly. On examination there is a tumor as large as a small peach, involving the thickness of the left cheek. It extended from near the ear to the angle of the mouth. On bimanual examination from within, an intrabuccal projection could be felt. The skin could easily be moved over it. The surface of the tumor was lobulated and there was a sense of fluctuation in it. The operation, done from without, revealed a lipoma, which in places had undergone a myxomatous degeneration.

The second case (Fig. 5) was of a little girl, five years old, who was operated upon in Russia, where at the age of one year a tumor was removed through an incision made near and parallel to the margin of the lower jaw. Examination revealed the presence of a uniform swelling of the left cheek, extending from the zygoma to the angle of the mouth. This was very much depressed. Between the dental arches the tumor mass projected as a roll, about the shape and size of an adult thumb. Skin and mucosa were easily moved over the swelling which was of firm consistence and of even surface. An attempt to remove the growth through the old incision failed, so that an enucleation through the mouth was done. The tumor could not be removed in one mass, but was removed piecemeal. The pathologist reports that for a lipoma, there was an unusual development of fibrous and lymphangiomatous tissue, much in excess of what is found around or within the capsule of the ordinary lipoma. This is interesting in view of an observation first made by Butlin [16] in connection with the report of a congenital lipoma removed from the calf of the leg. It is that the congenital lipoma nearly always presents a greater admixture of fibrous tissue than the acquired lipoma, and that very often, as was stated in the beginning of this article, they are associated with conditions of lymphangiectasis.

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A STUDY OF SECONDARY HEMORRHAGE TREATED BY LIGATION OF THE COMMON CAROTID ARTERY

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One of the most dangerous accidents which ever complicates a surgical case is secondary hemorrhage from an infected wound communicating with the cavity of the mouth, or from an infected cervical defect out of which the lymph-glands and connecting lymphatics have been taken, as is done in removing a malignant tumor from the jaw, floor of the mouth, or the tongue. Such a high mortality has followed this accident that the recital of the history of the following successful case may be of value, and the means which effected the patient's rescue may, if imitated, be productive of similar happy results in other instances.

Report of Case.—H. S., a white male, aged fifty-four years, was admitted to St. Anthony's Hospital, November 24, 1915, on account of a tumor of the left lower jaw. He was a perfect specimen of manhood with no abnormalities, excepting the lesion in the mouth. The gum at the site of the bicuspids on the lower left jaw is the seat of a sloughing tumor, size of a small pecan (if it were whole), and extends towards the floor of the mouth. No glands or extensions palpated or seen. There is an area of leucoplakia surrounding it posteriorly. The breath is foul and many teeth are missing. Only the two lower central and lateral incisors, upper and lower first molars on each side are present. All are decayed and surrounded at the base by a soft, spongy gum from which pus is expressed at will.

On November 29, Dr. Bartlett operated for the removal of the growth. Anæsthetic: Ether, intrapharyngeal. The intratracheal method, which had been chosen, was abandoned, since the tube proved such a hindrance to the operator, but instead, one No. 18 male catheter was inserted into each nostril down to the pharynx, the catheters being connected with a bottle containing ether through which air was pumped into the lungs by means of a foot bellows.

Through a Kocher incision down the middle of the chin and well under the jaw-bone, were removed in one piece the lym-

phatics of the superior cervical triangle, the submaxillary gland, part of the floor of the mouth, and all of the left half of the inferior maxilla as far back as the angle. The mouth wound was entirely closed and the defect packed with iodoform gauze, down to which the platysma and skin were sutured.

The gauze pack was removed on the fourth day; the wound drained freely, and for six days required dressings four times a day. The following few days only two changes were necessary, and during two days before the patient was discharged, the wound required but one dressing. Dry sterile gauze was used throughout. The discharge, at first, was seromucous tinged with blood, but, after three days, it became mucopurulent with an admixture of food particles, continuing so for five days, after which no more were noted, but the discharge retained its purulent character as long as the patient remained in the hospital. The stitches were removed on the tenth day. The suture line in the skin had been reddened and swollen for three previous days, but pure glycerin packs aided the wound to close perfectly. The wound inside of the mouth was kept as clean as possible with an alkaline mouth-wash, which the patient used at least four times during the day.

On the twelfth post-operative day, the man was discharged, the incision inside the mouth being apparently healed, as was also the skin incision, excepting an area 3 cm. long, and 2 cm. wide, through which the neck wound had been packed. It was still open, and led into a pyramidal cavity, the base situated at the opening in the skin incision, the apex extended deep into the neck and toward the lobe of the ear. Its sides were composed of sloughing tissue and granulations, from which came the discharge. The general health had become very good, and the blood-pressure was the same as when first admitted; as the further post-operative course promised to be uneventful, the future treatment was entrusted to the patient's family doctor.

He had remained at home not more than thirty-six hours, when he was awakened at 3 A.M., December 12, 1915, by a profuse hemorrhage from his neck and mouth. His wife estimated the blood at one quart. When seen by Dr. Bartlett at 11 A.M., he was pale, anxious, and uncomfortable. The pulse was small and rapid. He was at once returned to the hospital and put to bed.

The blood-pressure, taken immediately, was 127 systolic, 60 diastolic. Pulse was 80, respirations 24, temperature 98, hæmoglobin 85 per cent. The patient was kept at absolute bed rest, all visitors were denied, morphine gr. ¼ (hypo.), given morning and night, and every effort made to keep him from getting excited.

The wound was irrigated twice each day with 95 per cent. ethyl alcohol, in an attempt to prevent further sloughing of the

granulating wound inside the neck. Otherwise, the patient was accorded the treatment which he received when previously in the hospital.

For four days he did nicely. The discharge had diminished one-half, the blood-pressure had steadily fallen to 100 systolic, 65 diastolic, and the hæmoglobin 80 per cent. He was feeling so well that he was anxious to get out of bed and said that further stay there was making him nervous. The next morning at 2 A.M., December 12, 1915, after a good sleep the fore part of the night, he was awakened by a sudden gush of blood from his mouth and from the granulating wound inside the neck, and in less than two minutes, between 400 and 500 c.c. of arterial blood had been lost. The hemorrhage was stopped by compressing the common carotid artery between the thumb and the carotid tubercle, on the transverse process of the sixth cervical vertebra. This is directly in a horizontal line drawn parallel with the cricoid cartilage, and the common carotid artery, lying on it, is easily found.

Immediately following this second hemorrhage, morphine gr. ¼ (hypo.) was given, and in twenty minutes he was asleep and rested well until morning. Excepting the fall in blood-pressure to 90 systolic, 65 diastolic, there was no apparent ill effect of the accident, so the same general treatment was continued as before. However, the improvement was very slow, and by December 19, 1915, the blood-pressure was only 80 systolic, 55 diastolic, and the hæmoglobin 75 per cent. On this date at 7 P.M., another hemorrhage started exactly as before, but was stopped by the nurse in about twenty seconds, by compressing the common carotid artery as had been done the previous week, and the loss of blood was not more than 50 c.c. After a hypo. of morphine, gr. ¼, sleep was secured and continued uninterrupted throughout the night. The next morning, the patient was very nervous, appetite gone, and apparent anæmia very marked.

He was immediately taken to the operating room and the left common carotid artery ligated under local anæsthesia. The operation lasted but twenty minutes. Through a cross incision 4 cm. above the clavicle, we cross-cut the sternomastoid muscle and ligated the left common carotid artery with chromic catgut. After complete closure, we freely split the original flap upward and packed the defect with iodoform gauze.

Morphine gr. ¼, hypo., was required morning and evening for the first three days for restlessness only. He never at any time suffered any pain. The following three days only the evening dose of morphine was needed, after which no opiates of any kind were given. Narcotics were never necessary. The blood-pressure and hæmoglobin during the ten days patient was in bed are as follows:

December 20, 1915..systolic, 140; diastolic, 75; hæmoglobin, 60; Tallquist.
December 21, 1915..systolic, 140; diastolic, 78; hæmoglobin, 60; Tallquist.
December 22, 1915..systolic, 130; diastolic, 70; hæmoglobin, 60; Tallquist.
December 23, 1915..systolic, 125; diastolic, 75; hæmoglobin, 60; Tallquist.
December 24, 1915..systolic, 120; diastolic, 75; hæmoglobin, 65; Tallquist.
December 25, 1915..systolic, 120; diastolic, 80; hæmoglobin, 65; Tallquist.
December 26, 1915..systolic, 123; diastolic, 78; hæmoglobin, 70; Tallquist.
December 27, 1915..systolic, 125; diastolic, 80; hæmoglobin, 70; Tallquist.
December 28, 1915..systolic, 120; diastolic, 75; hæmoglobin, 70; Tallquist.
December 29, 1915..systolic, 115; diastolic, 75; hæmoglobin, 75; Tallquist.

The sudden rise of systolic blood-pressure from 80 to 140, and of diastolic from 55 to 75, after carotid ligation, illustrates most strikingly an interesting physiological point, viz.: the sudden damming of any large arterial trunk is followed at once by a marked rise in general blood-pressure, which is to be interpreted as a compensatory effort to supply the ischæmia area by dilating the collaterals. In this instance, nine days were required for the reëstablishment of the normal blood-pressure status, systolic 115, diastolic 75, which had obtained prior to the original operation. No doubt, the collaterals had by this time assumed to a sufficient degree the rôle formerly played by the common carotid. The hæmoglobin, however, while it steadily gained, never did reach its former percentage, in the hospital.

Water was given every two hours, 250 c.c. at a time. The appetite having returned, patient enjoyed the soft diet which was given every three hours, and in addition, large quantities of carrots, spinach, and red meats were consumed. The mastication of the food by this time was accomplished without any difficulty, and the right inferior maxilla retained approximately its normal position without any support save an ordinary face bandage.

At the end of the week, the stitches were removed, the ligation wound healing by first intention, despite the fact that the drainage from the high neck wound had flowed over it for more than a week. Infection of the new wound was prevented by colloidin dressings and special attention given to the draining wound.

The pack was removed after the third day, and each day iodoform gauze was reinserted until at the end of ten days, when the granulations had filled the wound to the skin edges and packing was very slight indeed. Two hours after the artery had been tied, the patient complained of a dull headache which disappeared in eighteen hours never to return. Eight hours following the operation, the right hand became numb and felt as though it were asleep. This sensation lasted only one hour, but returned after twenty-four hours, and remained with the patient thirty minutes.

For six days it continued, the numbness occurring in the morning just after the night's sleep, but this also then disappeared. For five days a "creepy" feeling was noted on the whole left side of the head, which would come and go, lasting but twenty minutes at a time. This was first complained of twenty-four hours after the operation, and on the sixth post-operative day disappeared completely.

On the tenth post-operative day, patient was allowed out of bed, and two days later was discharged. The blood-pressure remained 115 systolic, 75 diastolic, after he was up. There was no difficulty in walking or doing anything else. The upper wound had completely granulated in, and the skin had begun to cover the defect. Practically all discharge had ceased and the general condition was excellent. The red blood count was 4,544,000; white blood count 6400; hæmoglobin 75 per cent. Urine and fæces examinations were negative. There was no mental defect and the patient said he had never felt better in his life.

The happy termination of this case is referable to most persistent and painstaking after-treatment. A physician and nurse were constantly on guard after the first hemorrhage, with instructions as to how to compress the carotid artery against Chassaignac's tubercle. And the patient himself, a most intelligent man, coöperated in every detail of our organized campaign to save his life.

He was seen again on October 6, 1916 (about ten and one-half months after the operation), when his condition was as follows: There were no subjective symptoms of any kind, states that he can chew well enough for practical purposes with the few imperfect teeth that remain on the right side. There is surprisingly little deformity in view of the extensive bone removal, while the remaining half of the mandible is but slightly drawn toward the defective side. The scars are white, elastic, and not overly prominent. The patient is so well pleased with his appearance, that no beard is considered necessary, although a very heavy one is well within the possibilities in his case. His weight is 193 pounds, and the blood-pressure is 118–78, hæmoglobin 85 per cent., red count 4,480,000, white count 7000, clotting time, one and three-quarter minutes; urine is pale yellow in color, specific gravity 1010, reaction acid, there is no albumin, no sugar, no acetone, no indican, microscopic examination reveals nothing of pathological importance. Heart and lungs are apparently normal.

He was seen for the last time on December 28, 1916, just thirteen months from the day he first entered the hospital, and found to be in perfect condition. He had long been at work

and seemed to be wholly free from any sign of recurrence of the malignant disease.

A Study of the Literature.—In 1795, Mr. Abernethy tied the common carotid for hemorrhage, but without success. Mr. Flemming was the first to successfully ligate this vessel for hemorrhage in 1803. The first ligation of it for aneurism was made by Sir Astley Cooper at Guy's Hospital, in 1805, the patient dying nineteen days later. However, in 1808, he repeated the procedure with a successful outcome. Since that time this important vessel has been tied, with varying degrees of success, many hundreds of times in the treatment of a great number of morbid conditions. One of the most interesting chapters in the whole of surgery is made up of the conclusions of the various authors who have collected these results in the past.

Pilz, of Breslau, collected 600 cases of ligation of the common carotid, in 1868. In 386 cases of single ligation, 96, or 25 per cent., showed cerebral symptoms. Over one-half of the 96 died. In 27 cases, both common carotids were tied, 5 were fatal, 2 being deaths from cerebral disturbance. There were convulsions in another, not causing death, however. There were three temporary disturbances of vision. In one case, where both carotids were tied simultaneously, coma and death resulted. When an interval of a few days or weeks is allowed, double is no more dangerous than single ligation. The most common cause of death is cerebral disease.

G. W. Morris, from records of the Pennsylvania Hospital, in 1847, collected 42 cases of ligation of the common carotid, with 13 deaths.

Fisk cites that Cripps collected 50 cases of ligation of the common carotid in American and English literature, in which 56 per cent. had brain symptoms.

Schlatter collected 789 cases of ligation of c. c. a., 49 developed hemiplegia, 1 imbecility, and 18 delirium, convulsions and other cerebral disorders. Of those who lived a short time, or recovered, more than 7 per cent. developed paralysis.

Wilder says the statistics of Reuchlin and de Schweinitz show that in 150 cases of ligation of this artery, 97, or 64.6 per cent., were cured, 38, or 25.3 per cent., were failures, 15, or 10 per cent., died. The ligation of the common carotid is a safer procedure than ligation of the internal carotid because liberal anastomosis between right and left externals allows some blood to flow back around the bifurcation of the common and hence the brain is not so suddenly exsanguinated as if the internals were tied.

Callison and MacKenty reviewed 60 cases in the literature, find-

ing 3 carotids ligated in 32 cases, at 54 operations. Of the 22 deaths, 3 were from hemorrhage, 2 of cerebral anæmia, 1 of acute œdema of the lungs, 1 of septicæmia, and 1 of infection and hemorrhage. In the surviving cases, 4 had aphasia and hemiplegia, 4 had voice affected and dysphagia, 5 had tongue deviated to side, 4 had an altered pupil, and 4 had face partly paralyzed.

Martin gives *general* mortality of ligating common carotid 20 per cent. plus, and mortality of ligating it in pulsating exophthalmos as less than 2 per cent. De Schweinitz and Halloway give mortality of ligating the common for this malady as 1 per cent., with 10 per cent. disturbance of the cerebral nervous system. The carotid ligation is successful in two-thirds of the reported cases.

Wyeth cites 67 cases from literature of ligation for aneurism in which there were 14 cures, 1 improvement, 2 recoveries with permanent cerebral complications, 7 deaths from cerebral complications, 43 deaths from rupture of sac, hemorrhage, asphyxia, or some intercurrent disease.

It will be seen from the foregoing statistical studies that about one-third of all the patients on whom ligation of the common carotid has been performed died. When one takes into consideration that very many of these operations were done in the pre-aseptic period, it may be assumed that the mortality for the age in which we work will be considerably lower. The practical deduction to be drawn, however, is that an operation attended by a mortality of about 33 per cent. is distinctly preferable to the repeated recurrence of secondary hemorrhage in a region where it leads, as is generally agreed, to a 100 per cent. mortality.

In order to determine just what per cent. of ligations have been done for the control of secondary hemorrhage resulting from surgical procedure, like the one reported above, we have carefully studied the first 105 cases, including our own, which confronted us in the literature. Eighty-two of these ligations were done for aneurism, pulsating exophthalmos, angioma of the face and scalp, as preliminary to, or simultaneously with, the removal of tumors in the carotid area, and for trifacial neuralgia.

LIGATION OF COMMON CAROTID FOR INDICATIONS OTHER THAN HEMORRHAGE

1. Browne reports a successful case of simultaneous ligature of the subclavian and carotid arteries for innominate aneurism. Male, thirty-two. No cerebral symptoms, and result good.

2. Wolfe had a case of aneurism in the orbit which he cured by ligature of the common carotid. Woman twenty-two.

3. King, in a man forty, ligated the carotid and the subclavian arteries for an aneurism in the neck. No cerebral symptoms.

4. Lediard, for aneurism of the arch of the aorta, tied the carotid and subclavian arteries in a man forty-two. No cerebral symptoms.

5. Palmer reports a case that died of hæmoptysis and convulsions 125 days after ligating the carotid and subclavian arteries for aneurism of the aorta and innominate.

6. Wyeth, in a woman forty-two, simultaneously ligated the carotid and subclavian for aneurism of the aorta. No cerebral symptoms.

7. Bryant had a man, forty, die nineteen days after ligating the left carotid for innominate aneurism. Œdema and gangrene of the left lung.

8. Jaeffreson, woman forty-five, for aneurism of the carotid in the left cavernous sinus tied the common carotid. Aphasia in three days, paralyzed right side on the seventh day, and died on the eighth day.

9. Barwell reports 4 cases of ligation of the common carotid and subclavian arteries for aortic aneurism. Three of the cases successful.

10. Heath tied the common carotid in a woman, twenty-three, for aneurism of the external carotid. Good recovery to thirty-third day, then paralysis, and died thirty-fifth day.

11. Lyman tied the carotid with double silk ligatures and divided the artery in the treatment of innominate aneurism. Transient headache, hoarseness, and cold right ear. Patient died one year later of exhaustion.

12. Padeger did a simultaneous ligature of the carotid and subclavian arteries for innominate aneurism in a man, sixty. Left hemiplegia two days later. Recovered sensibility but not motion. Died year later with pneumonia.

13. Bull successfully tied the common carotid in a case of pulsating exophthalmos of traumatic origin. No cerebral symptoms.

14. Post removed portion of the common carotid in removing a tumor of the neck. Temporary paralysis of bladder. Death four months later.

15. Bettman cured pulsating exophthalmos by ligating the common carotid. No cerebral symptoms.

16. Morris, after one unsuccessful attempt, tied the common carotid for aneurism of external carotid in a woman forty-five. No effect from the ligation.

17. Lilienthal, for pulsating exophthalmos in a woman twenty-nine, tied both common carotids. Interval between operations fourteen days. Recovery.

18. Summers, in a man forty-five, ligated both external carotids, and sixteen days later the left common carotid for an angioma of the scalp. No cerebral symptoms.

19. McBurney reports a successful ligation of the carotid and subclavian arteries for innominate aneurism. Male thirty-five.

20. Wharton reports innominate aneurism cured by double distal ligation of common carotid and subclavian arteries. Operation by Ashhurst. No cerebral symptoms. Man forty-two.

21. Cameron, for innominate aneurism tied the right carotid and subclavian arteries in a woman fifty-seven. Recovery with no cerebral symptoms.

22. Stimson, male thirty-four, tied common carotid and subclavian arteries for innominate aneurism, with no cerebral symptoms. Death twenty-one months later of phthisis.

23. Dent reports the death of a man, thirty-seven, after simultaneous ligation of the carotid and subclavian arteries ten days before, for innominate aneurism.

24. Godfray had a case of aneurism of the carotid with suppuration of the sac and rupture into the pharynx. Ligation of the common carotid. Male twenty-six. No cerebral symptoms; recovery.

25. Collins successfully ligated the common carotid in the treatment of an intracranial aneurism. No cerebral symptoms.

26. Collins also ligated the common carotid artery in a case of recurrent carcinoma of the tongue, tonsil, and floor of mouth. The patient, a woman of thirty-seven, improved generally in health.

27. Kennedy cured a pulsating exophthalmos in a man of fifty, by ligating the common carotid.

28. Parker tells of a sudden death one year after tying the common carotid in a man of forty-eight, during the removal of a tumor from the stylohyoid region. No immediate symptoms.

29. King ligated the external and common carotids for an intracranial aneurism in a woman thirty-two. Right hemiplegia and paralysis of left side of face and aphasia. Recovery with partial hemianæsthesia.

30. McIntyre ligated the external and common carotid arteries, in removing a lymphoma of neck. Pain at base of brain and dizziness for two days. Secondary hemorrhage controlled by compression.

31. Stimson reports a case of arteriovenous aneurism six months after a stab wound in the neck. Male twenty-five. Common carotid ligated. Loss of power of right hand and dizziness on fourteenth day. Recovery.

32. Marsh, in a man thirty years with aneurism of the aorta, tied the carotid and subclavian arteries. Man died of rupture of the sac three hours later.

33. Ballin cured a case of pulsating exophthalmos in a man forty-two, by ligating the common carotid. No cerebral symptoms.

34. Ricketts successfully ligated the common carotid for trifacial neuralgia. Gives list of 18 cases from the literature; 2 had temporary paresis.

35. Nicoll removed the tongue, right tonsil and fauces for cancer, seven days after ligation of the right common carotid and left lingual arteries.

36. Hechelman reports an uncomplicated recovery after ligating the common carotid in a case of pulsating exophthalmia. Female twenty-four years.

37. Ransohoff in a male twenty-two, ligated the common carotid for pulsating exophthalmos with good results. Collected 21 cases in which the common carotid was tied with 14 cures.

38. Harrington removed a malignant growth from the neck which had involved a considerable portion of the common carotid. No cerebral symptoms. Hoarseness and inability to swallow were transient symptoms. Made good recovery, but died four months later from the progress of the cancer.

39. Croft had a case of glandular swelling of the neck which corroded into a pulsating tumor-like aneurism. Common and external carotids tied. Complete recovery.

40. Sheldon ligated the common carotid for aneurism of the innominate artery in a male forty-two years. Patient had a severe secondary hemorrhage and died before the innominate could be tied.

41. Barwell did a simultaneous ligation of the carotid and subclavian arteries

in a woman forty-eight years with an innominate aneurism. Complete recovery. This was his sixth case, with five recoveries.

42. Banks had a case die of hemorrhage after ligating the carotid and subclavian arteries.

43. Stimson, in a man forty-eight, first tied the common carotid for an aneurism of the innominate, and noticed no cerebral symptoms and no improvement. A year later he ligated the subclavian and noticed some improvement. Patient died three years later of Bright's disease and pulmonary œdema.

44. Wyeth had a man, fifty-four, die twenty-six hours after incomplete removal of a neck tumor, which had involved the common carotid to such an extent that it and other vessels had to be tied.

45. Wheelock reports a case of traumatic exophthalmos, female eleven years. Ligation of right common carotid gave only temporary improvement. Complete recovery followed ligation of left common carotid, one year later. No cerebral symptoms.

46. Damainville, female, forty-three years. The case was one of pulsating nævus on the right cheek. Recovery after ligation of right common carotid. Transient pain in right arm.

47. Bull, in a man, twenty-six years, ligated the common carotid for aneurism of external carotid. Left pupil contracted, tongue deviated to right, slight loss of power in right hand, face drawn to right side, speech O. K. Symptoms cleared in a few days.

48. McGill ligated the common carotid for right carotid aneurism. The patient, a woman sixty-two years old, suffered no cerebral symptoms and completely recovered.

49. Wells observed no symptoms after ligating the common carotid and right subclavian arteries for aneurism of the aortic arch in a female of seventy years.

50. Keen and Funke had a patient die of œdema of the lungs two days after ligation of the common carotid for a tumor of the carotid gland.

51. Marchand, in a woman thirty-two, ligated three carotids and a jugular vein for lymphoma of the neck. Patient died the third day of bronchopneumonia.

52. Paltauf observed hemiplegia, paralysis of right hypoglossal and facial nerves, and aphasia, on the fourth day after ligation of three carotids in removing a lymphoma. Symptoms cleared, aphasia last of all; no recurrence in four years.

53. Paltauf also experienced a death in a few hours from secondary hemorrhage following the ligation of three carotids and a jugular.

54. Paltauf ligated three carotids in removing tuberculous glands in a woman eighteen. Post-operative paresis of the left vocal cord.

55. Kauffmann and Ruppaner ligated the common carotid, internal carotid, and jugular, in a woman of twenty. There was hoarseness, and a small inactive left pupil. Patient died on the second day of double inhalation pneumonia.

56. Kopfstein noticed a narrowing of the left pupil, paralysis of the left palate, and hoarseness of voice, after ligating three carotids, superior thyroid, lingual, external maxillary, ascending pharyngeal and jugulars.

57. Malinowsky reports a recovery, after ligating three carotids, superior thyroid, external maxillary, and jugular, in a woman of thirty.

58. Monckeberg ligated three carotids, and noticed a right sided facial paralysis and aphasia on the second day. Patient recovered.

59. Monckeberg, in a man fifty-two years, ligated the common and internal carotids and internal jugular vein. Patient died on the third day with hemiplegia, aphasia, and inhalation pneumonia.

60. Siniouschine ligated three carotids in a woman forty-one; tongue deviated to the left, and drooping of right angle of mouth; recovery.

61. Scudder ligated three carotids in a woman thirty-two years. Recovery.

62. MacPhatter reports a complete recovery in a woman thirty-one, after ligating three carotids and the jugular.

63. Funke ligated three carotids and the internal jugular in a man forty-eight years. On the eighth day had severe headache, rapid loss of weight, irrational, and died in nine weeks of cerebral hemorrhage.

64. Gilford and Davis in a man sixty-two, ligated three carotids. Hemiplegia and pneumonia, with death on the seventh day.

65. Da Costa tied three carotids of the internal jugular, of a man fifty-two. Twelve hours after operating, patient had left hemiplegia, which rapidly cleared in a few days. Secondary hemiplegia occurred a week later, and slowly cleared; atelectasis of one-half the left lung. Recovery.

66. Howe ligated the left common carotid artery in the removal of the lower jaw of a female of forty-nine years. Hemiplegia of right side next day. Coma following day, death the fourth day.

67. Grene tied three carotids in a female, seven years, for a tumor of the right side, followed by right sided paralysis; never entirely recovered.

68. Makara reports a death of softening of the brain, on the third day after ligating the common, internal, and external carotids in a man eighteen, who had a tumor of the right side of the neck. Hemiplegia, and fever and dysphagia on the second day.

69. Dobremischoff: female, twenty-five, death the next day after ligating the three carotids for tumor of the left side.

70. Wooley and Fee had a case of goitre and tumor on the right side in a woman of sixty-eight. Patient died on the twenty-third day, of septicæmia.

71. Lilienthal noticed complete aphasia and hemiplegia, left eyeball soft and contracted, on the day following a ligation of the common carotid, in a woman fifty-six, whose primary lesion was an endothelioma of the carotid body. Aphasia and hemiplegia disappeared, but pupil remained contracted.

72. Cook excised the common carotid, which was involved in a tumor, in a man thirty-nine. Patient died one hour later of shock.

73. Eliot cured a pulsating exophthalmos by ligating the common carotid artery. No cerebral symptoms. Recovery.

74. Wilder reports pain in head for one week and occasional neuralgic pains in right side of face and head, after ligating the external carotid for pulsating exophthalmos.

75. Wilder reports another case of pulsating exophthalmos, which was finally cured by ligating the common carotid. Three days later, patient had complete paralysis of the muscles of left forearm and hand and difficult speech. Speech returned, but muscular power not completely. He makes a note that ligation of the common carotid is a safer procedure than ligation of the internal, because the liberal anastomosis between the right and left external carotids allows some blood to flow back around the bifurcation of the common carotid, and hence the brain is not so suddenly exsanguinated as if the internal were tied.

76. Cathcart, in a man thirty-three, tied the common, internal, and external carotids in removing a tumor of the neck. No symptoms.

77. Zondek tells of a good recovery made by a patient sixty-three years old, after a ligation of three carotids in the removal of the carotid gland.

78. Graham reports an operation by Crile, in which he ligated all of the carotids; recurrent laryngeal, and superior cervical sympathetic nerves were divided. Severe shock. Next day left pupil contracted, left eye paretic, marked hoarseness. Weakness of calf muscles and arm developed. Otherwise complete recovery.

79. Boni mentions no post-operative sequelæ following ligation of the common, external and internal carotids in removing a tumor of the neck.

80. Martin tells of a cure of pulsating exophthalmos following ligation of the common carotid artery, in a man forty.

81. Martin, in a man fifty-six, cured deafness of the right ear, blindness, tinnitus, and pulsating exophthalmos, by tying the right common carotid until the orbital pulsation ceased. Recovery.

82. Martin again successfully treated a pulsating exophthalmos by partial occlusion of the common carotid artery in a man twenty-four.

Seven of these 105 ligations, which were analyzed, were made in the treatment of spontaneous hemorrhage into the nose, nasal pharynx, oral pharynx or mouth.

1. Thomas records a case in which he ligated both common carotid arteries to control severe epistaxis in a case of inoperable sarcoma of the jaw. The first ligation gave only temporary relief, and was followed by no symptoms. The second ligation, done two months later, was followed by death in coma on the next day.

2. Wyeth, in 1881, tied the right common carotid of a woman fifty-three. Hemorrhage from a malignant growth of the antrum and orbit successfully stopped. Patient died seven months after ligation.

3. Collins ligated the right common carotid in a man of fifty-three, for hemorrhagic ulceration of right tonsillar region. Condition greatly improved.

4. Mahomed, in 1882, stopped a hemorrhage from a post-pharyngeal abscess, by ligating the common carotid. Recovery with fixation of the left vocal cord.

5. Wilkinson controlled bleeding from an angioma of the face, by ligation of the common carotid, after an unsuccessful attempt by ligating the facial artery. No cerebral symptoms.

6. Ferguson in the case of a woman, nineteen, suffering with aneurism by anastomosis on the head, and severe hemorrhage, ligated the common carotid. No cerebral symptoms. Recovery.

7. Blaker ligated the common carotid artery of a man, forty-five, with a case of epithelioma of tongue, with repeated hemorrhage from lingual artery for two days. Transient pain was present in left arm, right knee, and side of face, head, and tongue. Death in five months.

Only 15 of the 105 ligations which we are studying in detail were made for the control of hemorrhage, secondary to surgical operations,

etc., involving injury to one of the branches of the common carotid artery.

1. Rivington, male thirty-one, stab wound in neck which became infected and gave rise to severe hemorrhage on twenty-first day. Common carotid ligated, then external carotid ligated and ligature loosened from common carotid; recovery.

2. Sands encountered an obstinate hemorrhage after an amygdalotomy in a man of twenty-four years. Patient prostrated, saline infusion; recovery.

3. Byrd had a case, boy seven, of gangrene of cheek and neck, starting from a carious tooth. External carotid eroded, hemorrhage, common carotid ligated with no cerebral symptoms. Death in two days from general sepsis.

4. Ashhurst reports epileptiform convulsions coming on six months after ligation of the common carotid for secondary hemorrhage from a stab wound in the neck.

5. O'Neill, male forty, for hemorrhage from incised wound behind angle of jaw, ligated the common carotid; delirium for two days and severe pain in side of face. Slight facial paresis for four months, but final recovery.

6. Browne cites an instance of a man thirty-two years, who had severe hemorrhage from infected neck laceration following a kick from a horse. Involuntary bowel movements for three days following common carotid ligation; recovery.

7. Preston, male, forty-seven, an attempted suicide by cutting throat. Wound infected and severe hemorrhage six days later. Common carotid tied. Improvement for a month. Death three months later from apoplexy. Postmortem showed softening of base, and cerebellar abscess.

8. Jones, S. E., excised the left half of inferior maxillary, in a man fifty-five years old, with epithelioma of lip and infection of two years' duration. Hemorrhage from left side of the mouth followed. He ligated the common carotid artery. Patient given saline transfusion. Complained of headache in left side, but no other cerebral symptoms.

9. Rivington, in a boy nine years, who had severe hemorrhage after swallowing a fish bone, tied the left common carotid artery. Death ten days later, of brain abscess on left side.

10. Thormer performed ligation of the common carotid artery successfully on a man, thereby controlling epistaxis in the most serious form.

11. Shepherd reports ligation of left common carotid for meningeal hemorrhage. Aphasia for two days. Recovery.

12. Hewetson resorted to ligation of the left common carotid artery, and saline infusion, to control hemorrhage for an eroding cancer of the neck. Right-sided hemiplegia and dilatation of the right pupil and contraction of the left pupil were noticed on the day following ligation. Patient died without regaining consciousness.

13. Callison and MacKenty tell of a fatal termination of an attempt to ligate the common carotid to stop severe hemorrhage, incident to the removal of a malignant mass.

14. Lane saved the life of a man, twenty-one, with severe hemorrhage after tonsillectomy, by ligating the common carotid and infusing saline solution.

15. Ransohoff ligated the common carotid for secondary intracranial hemorrhage. Conscious the next day. Result not reported.

A perusal of the 105 cases quoted above will show that only 15.25 per cent. of the ligations were done for secondary hemorrhage, while 6.66 per cent. were done for spontaneous bleeding in the carotid areas. 78.1 per cent. were undertaken in the treatment of conditions which did not immediately indicate a speedy approach of death. Surprising as is the outcome of this analysis, it coincides fairly well with our clinical observations; for we know of a rather large number of patients (some of them our own) who have succumbed to recurring spontaneous or secondary hemorrhage without any attempt being made to relieve the condition by ligation of the common carotid. This statement becomes all the more impressive in view of the fact that 10 of the 15 patients studied above made a complete recovery after ligation of this artery in the treatment of repeated secondary hemorrhage from its branches. It will be seen that the mortality attending this treatment of secondary hemorrhage, with its otherwise practical certainty of a speedy fatality, is no greater than the general mortality of about 33 per cent. which has followed the ligation of this large vessel in many hundreds of instances in the treatment of the greatest varieties of pathological conditions. We are forced to the final conclusion that secondary and spontaneous hemorrhages from the branches of the common carotid are very frequent, and still ligation of this vessel, which saved two-thirds of the patients involved, was performed for this indication in but 15.25 per cent. of the cases analyzed. Must we not then ask ourselves in all seriousness, why modern surgery has *not* furnished this 66 per cent. chance to those sufferers who practically all die, under circumstances of a particularly distressing nature, unless this simple operation be performed?

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A STUDY OF THE MOTOR DISTURBANCES ACCOMPANYING ULCER OF THE STOMACH OR DUODENUM AND THE CHANGES PRODUCED BY OPERATION

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In discussing the disturbances of function which are initiated by ulcer of the stomach or duodenum, the factor produced by any derangement of activity of the gastric musculature becomes an all-important one. After operative treatment for the cure of the ulcerative lesions, these motor disturbances do not always disappear immediately, but frequently continue for a variable length of time after convalescence is established and may cause the production of post-operative symptoms. These symptoms may have nothing to do with the original lesion, with a recurrence of it or with the appearance of new lesions of similar character but are incident to the proper recovery of the motor mechanism to normal conditions.

The special purpose of this report is to demonstrate the disturbances of motor function which accompany these ulcerative lesions and to point out the relationship of the particular disturbance to the actual lesion. The changes occurring after operation will next be considered and the differences or similarities to the ante-operative findings noted. Finally the post-operative changes will be followed over considerable lengths of time, and, when disturbances of function persist or reappear, the coincidence of these with post-operative symptoms of one kind or another will be described.

The methods made use of are those which were employed by Cannon and Washburn [1] and by Carlson [2] in purely physiological work, and for our purpose they were peculiarly applicable inasmuch as the studies reported here had to do with changes in the normal physiological functions of the gastric musculature which were caused by disease or which follow the formation of new anatomical relationships produced during operation.

Historical.—Observations of this kind were made as early as 1897 by Duchessi [3] who noted that the muscular activity was depressed in diseased conditions. Sick [4] in 1906 made observations in cases of large

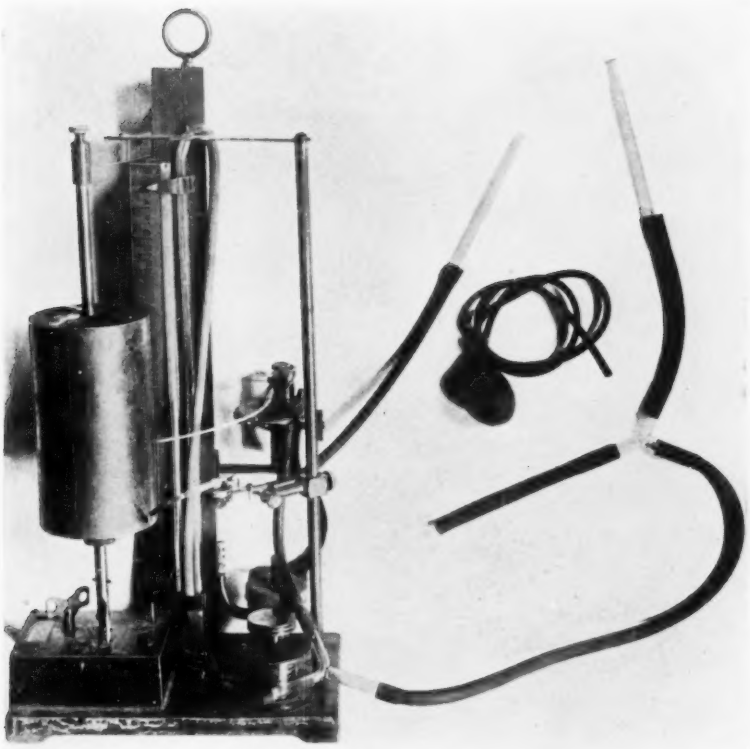

FIG. 1.

dilated stomachs in which he could see few tonus contractions and no hunger contractions. He also studied cases of pyloric stenosis and in these he recognized the erections of the stomach in the exaggerated tonus and hunger contractions of the tracings.

Kirschner and Mangold [5] studied the function of the gastric antrum and the pyloric sphincter after resection in continuity of the middle segment of the stomach. The rhythm and gastric contractions were unchanged.

In 1915 Carlson and Ginsburg [6] studied two infants with congenital pyloric stenosis. They demonstrated hypertonicity and hypermotility.

In 1916 Luckhardt and Hamburger [7] obtained records from a patient with gastric carcinoma and in a condition of acute gastritis. Little disturbance was noted in the former and a complete absence of motor activity in the latter.

Method.—By the methods of Cannon and Carlson kymographic tracings are obtained which record the intragastric pressures and the changes in rhythm and force of the tonus and hunger contractions as described in the original physiological work of Cannon and Washburn [1] and of Carlson [2] and in some of our work [8, 13] previously published. These tracings are obtained by introducing into the patient's stomach a small-sized rubber (toy) balloon which is connected by means of a narrow calibered rubber tube with a tambour and recording needle and with a mercury manometer. Transmission of the intragastric variations occurs through the column of air in the balloon and tubing. The apparatus which was used was extemporized out of an old discarded Erlanger sphygmomanometer and a photograph of our apparatus is shown in Fig. 1.

Extraneous inhibiting influences which would tend to negative the reliability of the records obtained were rigidly excluded in the cases reported upon in this paper and no tracing was accepted when tolerance of the tube and balloon was not exhibited. As a general rule, owing to previous manifold experiences with stomach examinations of one kind or another, the patients were enabled to swallow the balloon and tube voluntarily and with ease and frequently within a short time dropped off to sleep and continued in that state for the major part of the observation. The length of time for which records were made varied between one-half and one hour. Whenever the tracing method showed no evidence of muscular activity, the record was controlled by having the examination repeated on a subsequent day. When all of these factors were considered the records furnished true indices of the state of the motor activity and the changes in intragastric pressure. These records were then compared with the results of X-ray exam-

inations made by Dr. Jaches * and his associates in the X-ray Laboratory of Mount Sinai Hospital.

Physiological Work.—The work † of Cannon and Washburn [1] and of Carlson [9] has shown that in normal stomachs there is a constant variation in the tonicity of the smooth muscle layers, which, graphically, is represented in the kymographic tracings as a rhythmical rise and fall of the lever repeated about once every twenty seconds. The intragastric pressure is only of moderate degree (up to 5 mm. Hg). These slow contractions are interrupted at regular intervals by sharp rises of the lever to greater heights which correspond to pressures many times as great as in the preceding variations. These indicate active contractions of the stomach wall. The latter are known as "hunger contractions," the former as "tonus contractions."

The hunger contractions may repeat themselves rapidly for periods lasting up to an hour or more in length, or are separated by periods of varying length in which only tonus contractions appear.

Pathological Work.—The cases upon which the studies reported in this paper were made were all pathological, and in all of them, with the exception of the control cases, a "peptic" ulcer could be demonstrated at operation, either in the stomach or duodenum. The observations ‡ to date number ninety-three. Of these eighteen are controls, the records having been obtained from patients in whom, later at exploratory operation, no lesion could be found in the stomach or duodenum. In a number of the cases the records are not complete inasmuch as there is lacking either an ante-operative or a post-operative observation.

The state of the motor activity before operation has been found to conform to one of five types and these types may be classified as follows:

(1) The normal type: The tracings obtained in this group are similar in all points to those obtained as a rule from stomachs which show no lesion at operation, or in which there are no subjective symp-

* I am indebted to Dr. L. Jaches for permission to make use of the records of the X-ray Laboratory.

† It is unnecessary to repeat here in detail the original work done by Cannon and Washburn and by Carlson and his associates. For more detailed information reference is made to the original articles in the *American Journal of Physiology* for 1911 to 1915.

‡ The majority of the patients were observed while on the surgical service of Dr. A. A. Berg, to whom I am indebted for the permission of making these studies. The other cases were studied while on the surgical services of Drs. Moschcowitz, Elsberg, and Beer, or while on the medical services of Drs. Meyer, Brill, Manges and Libman. I am indebted to all of these gentlemen for the permission of making these observations.

toms of any kind that would lead one to suspect any abnormality of the stomach (Fig. 2). In these cases the lesion is usually found in the duodenum or at some part of the stomach in which it gives rise to little or no motor disturbances. About one-fifth of the records are of this type.

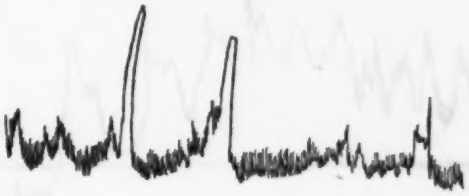

FIG. 2.—In this and all the other figures the upper curve represents the contractions of the stomach musculature and the lower curve is a control for the respiratory factor obtained from a pneumograph fastened about the lower thorax and upper abdomen.

(2) The hyperactive type: Large hunger contractions begin immediately and continue practically unchanged during the entire period of observation (Fig. 3). The tonus is distinguishable with difficulty and is overshadowed by the hunger contractions. The lesions are usually in the duodenum. These cases are in the minority.

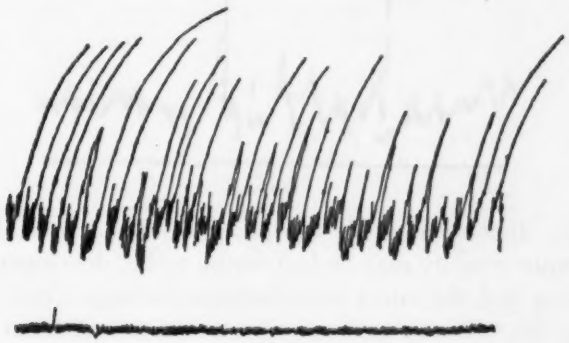

FIG. 3.

(3) The irregular type: The tonus has an irregular rhythm both in time and force and sometimes is replaced by atonic periods. The hunger contractions are also irregular in time and force and frequently lack the bold rise and fall of the healthy contractions (Fig. 4). The lesions are usually found in the antral portion of the stomach and along the lesser curvature. This type is present in about one-fifth of the observations.

The cases gathered in the first three groups are simple uncomplicated ulcer cases and in none of them had anatomical abnormalities resulted from the ulceration such as stenosis of the pylorus or cicatricial distortion of the body of the stomach.

FIG. 4.

In the two groups which follow, anatomical changes appear.

(4) The type seen in pyloric obstruction: When the stenosis is only of moderate degree and has not existed for an excessively long time the changes are slight and consist of a slowing of the rhythm with an increase in the intragastric pressure (Fig. 5). In the more advanced cases the tonus exhibits this same change to such a degree that at intervals the tonus contractions assume the characteristics of hunger contractions. This represents the peristalsis that is at times visible

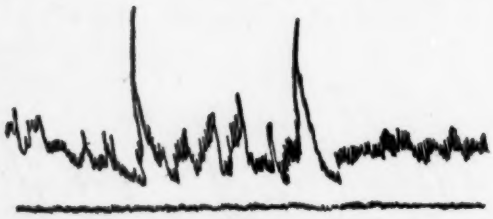

FIG. 5.

through the abdominal walls of these patients. In badly neglected cases all motor activity may be lost owing to the development of a secondary atony and the curve then indicates a large atonic and dilated organ (Fig. 6). This group comprises about two-fifths of the cases.

FIG. 6.

(5) The "atony" group: This division includes some of the cases in the preceding group in which the stenosis has initiated an exhaustion of the musculature and a terminal paralytic condition. It

includes, also, those cases of large callous ulcer situated on the lesser curvature or posterior surface of the stomach in which a reflex paralytic condition has resulted from the presence of a large inflammatory lesion. Frequently the clinical findings are those of a pyloric stenosis and the condition is often associated with a high grade of pylorospasm. In these cases the curve (Fig. 6) either shows no motor activity at all or only traces of tonus contractions appear separated by long intervals of total atony. No hunger contractions are seen. Such records formed about one-tenth of those obtained.

Post-operative Observations.—In a number of the control cases observations were made within a short time after the exploratory laparotomy. At this operation the stomach with its neighboring omenta and the transverse colon were withdrawn from the abdomen and the parts were handled in the fashion necessary for determining whether or not an ulcer was present in the stomach or duodenum. A lesion not having been found, the organs were returned into the abdomen and the external wound was closed. Such an exploration would last about fifteen minutes. In a number of these cases an appendicectomy was done.

In these cases the observations of the motility of the stomach made after recovery from the operation rendered records identical with

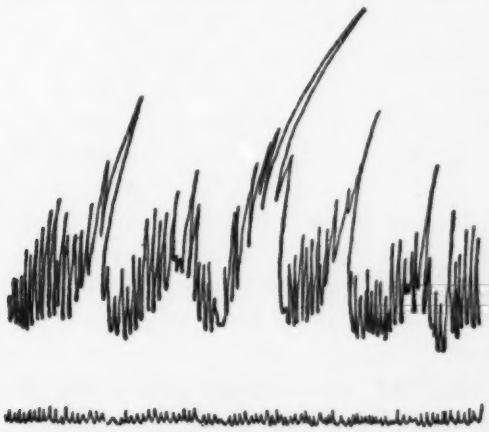

FIG. 7.—Tracing obtained before operation. Negative findings.

those before operation (Figs. 7 and 8). The handling of the organs, when no operative procedure was carried out, seemed to have no effect on the muscular function, or, if there was such an effect, it was transient and recovery to the normal was absolute and very rapid.

In the cases in which ulcers were found the operative treatment consisted either in (*a*) a retrocolic posterior gastro-enterostomy made

by suture or Murphy button, or in (*b*) a pylorectomy or partial gastrectomy with the necessary gastrojejunostomy usually made with a Murphy button. The sequence of events in the gastro-enterostomy cases (group *a*) which followed the operation may be summarized as follows:

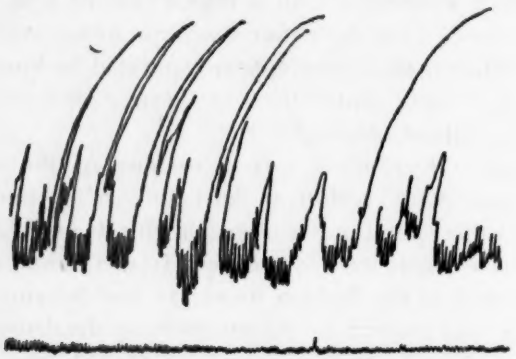

FIG. 8.—Same case as Fig. 7. Tracing obtained two weeks after operation.

1. The recovery to the normal was fairly rapid, and even as soon as two weeks after the operation very good tonus and hunger contractions could be demonstrated. These cases are in the minority.

2. The recovery to the normal was slower than in the first group, but for practical purposes was satisfactory. These were the cases which were in poor condition before operation, or in which a naturally poor vitality retarded the rapidity of the convalescence.

These two groups, and especially the first group, are most often to be seen with the early or moderately early cases of pyloric stenosis. Here the muscular function is excellent and when the obstruction is remedied a rapid improvement is almost always seen. This corresponds with clinical facts, inasmuch as cases of pyloric obstruction are known usually to give good results after operation.

3. Cases in which the disturbance had been so marked that the atony persisted to a slight or moderate degree after operation, recovery was very slow.

4. Cases in which the atony persists and in which at repeated examinations none or only slight traces of motor activity are visible in the tracings.

When the original atonic condition was due to reflex causes, the condition tended to a rapid improvement after the removal of the offending cause. When, however, it was the terminal stage of a pyloric obstruction, the condition usually dragged on for long periods after operation and was difficult to treat successfully.

5. Cases in which the motor function began to regain its normal

tone and continued to improve for a short while. Then for various reasons a deterioration occurred and later observations showed little or no evidence of motor activity.

The following two cases are cited as examples and illustrate graphically the post-operative sequence of events.

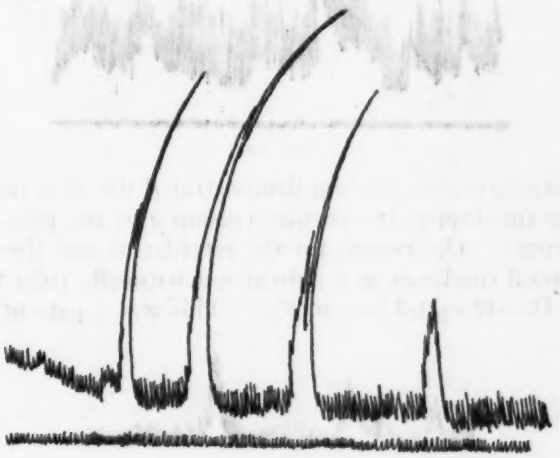

FIG. 9.

CASE I.—Hospital No. 160182. This was a patient in whom at operation a small ulcer was palpated in the first part of the duodenum, and for this a posterior retrocolic gastrojejunostomy was made after the method of Von Hacker and the pylorus was excluded by the string method. The motor activity of the stomach before operation is shown in Fig. 9. According to our preoperative classification this would fall into Group 1. A satisfactory convalescence was made and about three weeks later another observation (Fig. 10) was made. Only slight evidences of motor

FIG. 10.

activity were present at this time. Clinically the patient was without symptoms but said that he felt weak. The observation was again repeated several weeks later and at this time the patient was feeling much stronger. The tracing (Fig. 11) demonstrated that tonus contractions were present and at one point a fairly typical hunger contraction is seen. Another observation was made two months later, by which time the patient had regained most of his strength and was feeling very well. This tracing (Fig. 12)

demonstrated that improvement had continued to a degree corresponding with the clinical facts.

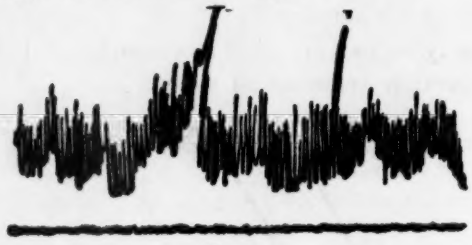

FIG. 11.

This was a cured case and demonstrated the slow recovery of the motor function to the normal (group 2 of the post-operative classification). The reason for the retardation was the impoverished general condition in a patient not naturally robust.

CASE II.—Hospital No. 160857. This was a patient in whom

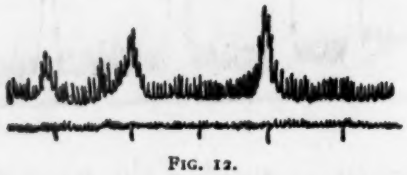

FIG. 12.

also at operation an ulcer was found in the first part of the duodenum. Similar treatment was accorded him as in the previous case described. The motor activity of the stomach before operation is shown in Fig. 13. According to our preoperative classification this would fall into group 2.

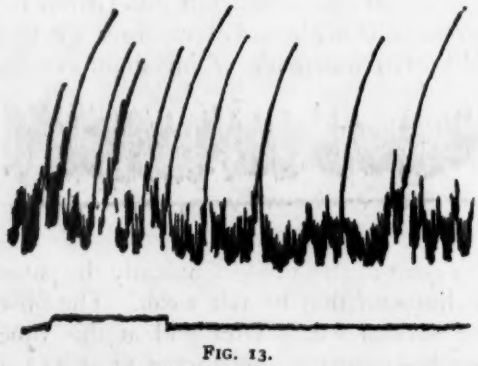

FIG. 13.

There was some vomiting during the first few days after operation after which the convalescence was uninterrupted. Twenty-six days after operation an observation was made and this is reproduced in Fig. 14. This showed a beginning return

of the tonus contractions. No hunger contractions were demonstrable. There were no symptoms at this time. Six weeks later the patient returned complaining of pain and vomiting. An observation made at this time showed no motor activity (Fig. 15)

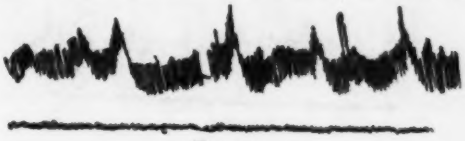

FIG. 14.

The symptoms continued unchanged and the observation was repeated three weeks later. The atonic condition still persisted (Fig. 16).

Six months later the patient was readmitted to the hospital and the observation made at that time demonstrated fairly satistory tonus contractions but no hunger contractions (Fig. 17).

FIG. 15.

A secondary exploratory operation was made but no anatomical lesion could be discovered. It was concluded, therefore, that the disturbances of this patient were of a functional nature.

This case falls into group 5 of our post-operative classification. Operation was followed by a temporary improvement, after which a deterioration occurred in the function of the gastric musculature. This corresponded with an appearance of post-operative symptoms. A discussion of this case was made in another publication.[10]

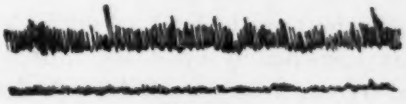

FIG. 16.

There were only a few observations on cases in which the method of operation consisted of a pylorectomy or partial gastrectomy (group *b*). In a general way it may be stated that the recovery to the normal after this type of operation followed the same general rules as after gastro-enterostomy. Disturbances of function were, however, relatively fewer and were less marked.

There were a few studies on gastro-enterostomy cases in which after

a longer or shorter time symptoms developed which at secondary exploratory operations were proven to be due to anatomical lesions which had produced a partial obliteration of the gastro-enterostomy stoma. In the presence of a pyloric exclusion abnormal conditions were neces-

FIG. 17.

sarily produced which resembled those noted under pyloric stenosis (ante-operative group 4) and the kymographic records showed similarities to those described under that heading.

Comparison with the X-ray.—In comparing the kymographic records with facts obtainable by X-ray examination, it must be remembered that with the latter method one is dealing with the stomach filled with food material (barium-zoolak mixture), whereas in the former all of the examinations were made on stomachs into which food had not been introduced for many hours previous to the examination (five to eighteen hours). A certain degree of discrepancy has been noted which can rightly be referred to this difference between the full and the empty stomach.

As a general rule the observations yielded by both of these methods of examinations have shown similarities. Wherever the motor activity gave good tonus and hunger contractions in the kymographic records, the X-ray demonstrated a "grasping" of the contained barium-zoolak mixture and the peristalsis visible was active and efficient and resulted in the emptying of the stomach within a normal period. The discrepancies mentioned above consisted mostly in seeing large peristaltic waves under the fluoroscope when no hunger contractions were seen in the tracings. It seems therefore that the digestive contractions are different from the hunger contractions. This seems to bear out the physiological observations made by Carlson[11] that the hunger contractions disappear immediately upon the introduction of food into the stomach. It also confirms the work done on dogs by Boldireff.[12]

The information rendered by the X-ray examination has often been amplified considerably by that given by the kymograph, especially in conditions of pyloric obstruction and stenosis of the gastrojejunal stoma. In these the obtaining of good tonus and hunger contractions would indicate that the musculature was functionating well and that disturbances of motor function after operation would be little or none. On the other hand, when no evidence of any motor activity was obtainable it bespoke an exhausted musculature and indicated a long period

of convalescence in which symptoms might arise due to this atonic condition.

Occasionally in large dilated stomachs one could see fair tonus contractions in the kymographic record. Here subsequent events showed that recovery took place much more rapidly than in those cases in which no tonal waves could be seen.

In the post-operative cases the facts obtainable by the kymographic examinations are very valuable in forming part of all the information elicited according to the methods described elsewhere,[8, 13] which have been developed for estimating the functional capacity of the stomach. Here it helps in determining whether any post-operative symptoms which may arise are functional or due to anatomical causes. In the functional cases they are of further value in estimating the good or bad effect of the method of treatment employed.

This method of examination, while having great value in estimations of the functional capacity of the stomach both before and after operation, has, up to the present, showed very little if any value as a method of precision in the diagnosis of gastric or duodenal ulcer.

I acknowledge with many thanks the kind assistance of Dr. J. Branower, of our house staff, in the preparation of much of the technical work embodied in this study.

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AN ANATOMICAL POINT WHICH FACILITATES THE LOCATION AND DELIVERY OF THE APPENDIX

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The attachment of the lower root of the mesentery opposite the sacro-iliac joint marks the point of juncture between the ileum and the cæcum. By its location, the appendix can be readily found and delivered without drawing any of the colon or the small intestine out of the wound. The advantages are obvious. With so little trauma to the intestine, the post-operative convalescence is made comfortable, the danger of infection is lessened, and the time of operation shortened within reasonable limits. The method can only be employed in cases in which the appendix lies free in the abdomen.

Through a muscle splitting or McBurney's incision the index and middle fingers of the left hand are inserted into the iliac fossa. The cæcum, lying directly underneath, is lifted well up in the iliac fossa by a cat's pawing action of the fingers, until the head is located (Fig. 1). The fingers are then swept along the course of the iliac vessels from without inward and upward, describing an arc of one-fourth of a circle, until the point of attachment of the root of the mesentery is reached. This is felt as a band, which marks the location of the ileocæcal juncture. The base of the appendix, if lying free in the abdomen, should be within three-fourths of an inch from this point. If the hand is now elevated slightly, anteriorly, and the fingers moved about, the appendix as a rule can be found (Fig. 2). Grasped between the fingers it can be delivered through the wound (Fig. 3).

Should a right rectus or midline incision be used, the band is located by sweeping the fingers in the opposite direction, *i.e.*, from within, outward and upward.

I have been impressed in my visits to clinics with the fact that many surgeons draw out large amounts of the descending colon and sometimes the small intestine in searching for the appendix, and that few employ the method described herein.

I am indebted to Chas. H. Mayo for demonstrating this method to me.

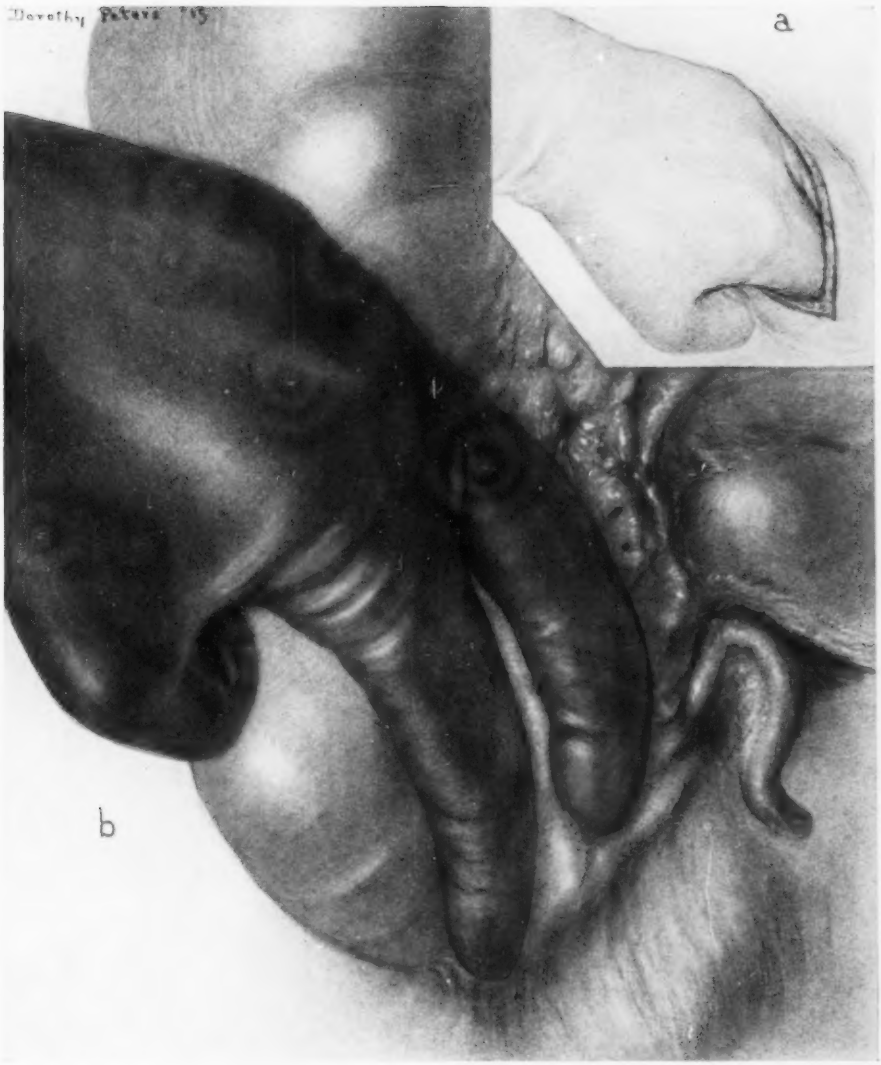

FIG. 1.—*a*, showing position of hand through abdominal incision; *b*, pulling head of cæcum up preparatory to the search for root of mesentery.

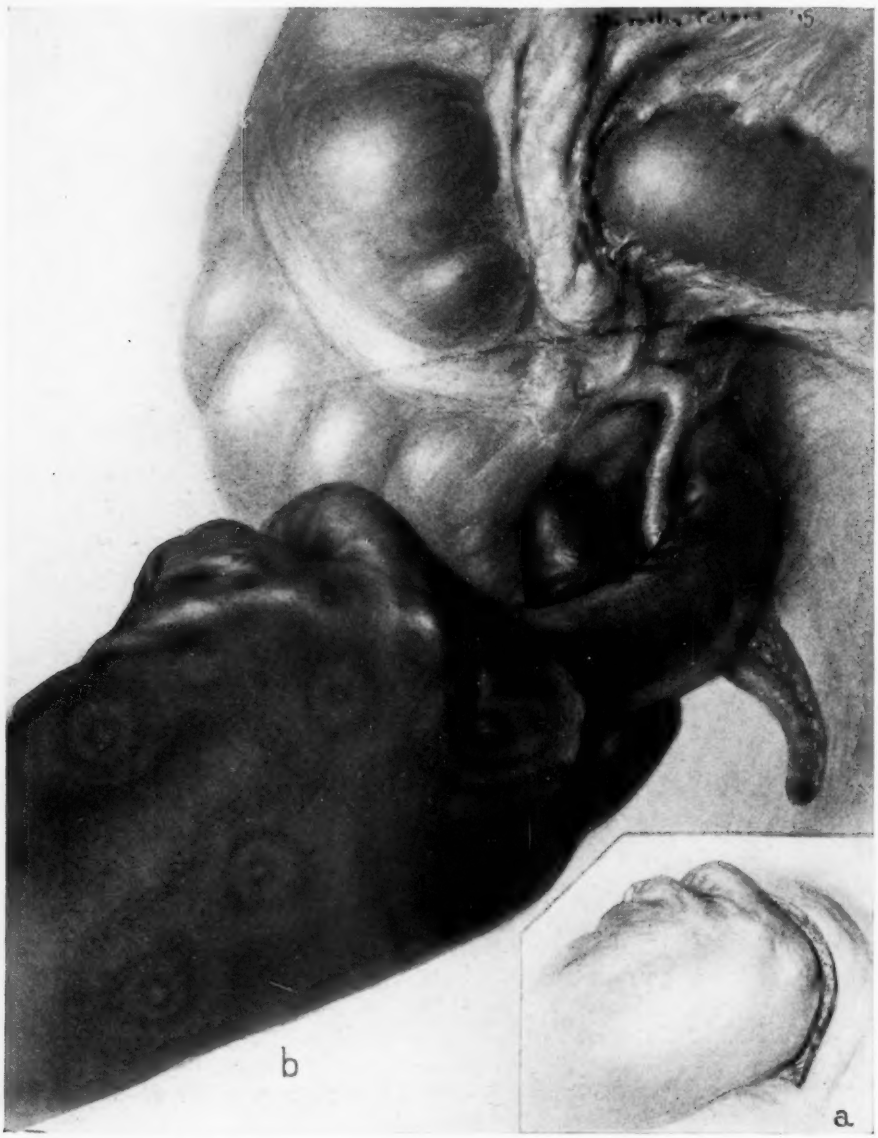

FIG. 2.—*a*, showing hand swept upward toward midline; *b*, root of mesentery located and appendix grasped between fingers.

FIG. 3.—Appendix brought through incision without delivery of cæcum or ileum.

CYSTIC DILATATION OF THE VERMIFORM APPENDIX

By Philip J. Reel, M.D.
of Columbus, Ohio

(From the Department of Surgery, the College of Medicine, the Ohio State University)

While by no means unique, cystic dilatations of the vermiform appendix are sufficiently rare, at least in the literature, to warrant a careful study of every available case. Dodge,[1] after a careful review of the literature, collected 142 cases and gave the percentage of incidence as ranging from 0.2 to 0.68 per cent. Undoubtedly in surgical practice this condition is encountered more frequently than the above statistics would indicate. Since the appearance of Dodge's paper, Graves [3] has reported two cases, Bailey [2] a case, and Ginsburg [4] another case.

It has been my privilege to make an intensive study of seven definitely cystic dilatations of the appendix found in the Museum of Pathology at the Ohio State University. Two of these were true hydrops of the appendix. The contents of the other five cysts were of mucoid materials.

It would appear that this condition may occur at any age, excepting possibly in the very young. It is well to remember, however, that the majority of these are discovered in the more active decades of life.

In the series to be discussed, sex apparently played no important rôle. Four occurred in men and three in women. This agrees with the cases collected by Dodge in which the sex was mentioned; 37 were in males and 24 in females.

Definite etiological factors capable of explaining each individual case cannot be stated. Partial and complete obliterations of the lumen, however, certainly played a very important rôle. It would seem impossible to find a true hydrops of the appendix without complete occlusion of the lumen. Two of the specimens in this series presented a condition of hydrops. In both instances the occlusion was complete. It is apparent, however, that this is not the only factor at work in the production of cystic conditions, since many specimens are encountered in which kinks, acute angulations, and complete obliterations are present without even a suggestion of cystic dilatation.

On the other hand, cystic formations, excluding hydrops, can occur in the appendix without obliteration of the lumen. In mucocele of the

appendix there is an increase in the number of goblet cells. This is, however, what one would expect. A routine examination of a large number of appendices reveals many specimens containing a marked increase in this type of cell without any retention of the secretion.

Little or nothing may be complained of by the patient. In the uncomplicated cases the symptoms when present are always those of a chronic lesion. None of these presented a rise in temperature or leucocytosis. They complained of intermittent attacks of pain referable to the appendix, accompanied by tenderness and sometimes nausea and vomiting. No symptoms whatever were complained of in two of my cases—one a hydrops, the other a mucocele. Both of these specimens were accidentally found at autopsy.

One of the complications most writers mention upon this subject is rupture of the cyst. It did not occur in this series. This may be possibly accounted for by the fact that none of these specimens had attained the enormous proportions described in some instances. Another and more frequent complication is a pyogenic infection superimposed upon the already cystic appendix. This complication occurred once in this series (Fig. 1). This was the case of a young man of twenty-seven, who came to operation because of the classical signs of acute suppurative appendicitis. The patient had had a similar attack of pain one year before, without a rise in temperature or an increase in the white cell count.

While none of these seven appendices presented the great size which has been recorded by certain authors, they are definite retention cysts of the organ. When taken together with many smaller dilatations which have been frequently encountered in healed (Fig. 2) lesions of the appendix they make an interesting group for study. The largest of these was 10 cm. in length and 6.5 cm. in circumference.

Apparently no characteristic shape can be ascribed to these specimens. The contour is, as a rule, regular and the surface smooth. Occasionally two cysts are found in the same specimen. In one instance there was a small cystic dilatation, occupying the first one-third of the appendix, following this a complete obliterative constriction and next a larger dilatation of the remainder of the organ. Subcysts and bosses may also be present.

Four of this series presented complete obliteration of the lumen proximal to the cyst; in three the lumen was found to be patent throughout. Six of the seven specimens presented adhesive bands more or less constricting their lumina.

The location of the obliteration appeared to be a definite factor in

FIG. 1.—A specimen of true hydrops of the appendix in which a suppurative inflammation was superimposed. The portion showing the complete obliteration had been removed.

FIG. 3.—A specimen of hydrops of the appendix removed at autopsy. Note the constricting band.

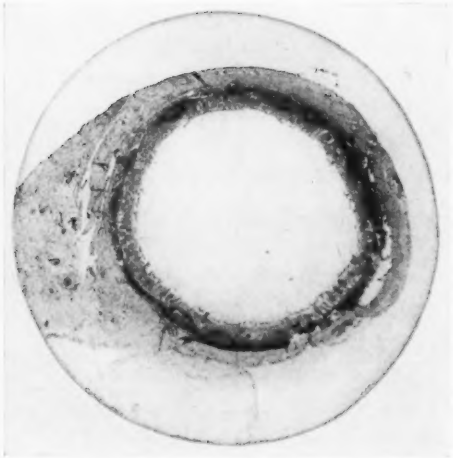

FIG. 2.—A cross-section of one of the smaller dilatations which are frequently encountered associated with obliterative lesions (×5).

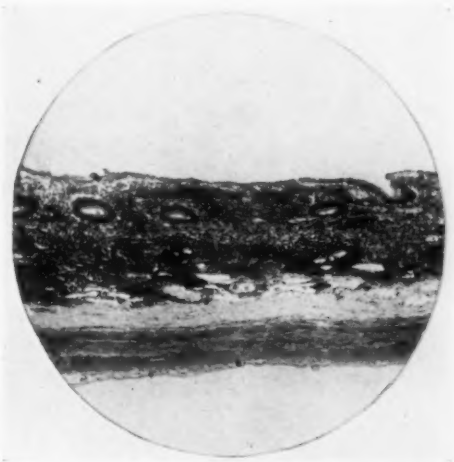

FIG. 4.—Wall of specimen shown in Fig. 1. Note the absence of the longitudinal muscle layer (×2).

FIG. 5.—A mucocele of the appendix with its coagulated contents.

determining the shape of the cyst. In case the obliteration was at the cæcal extremity of the appendix, the shape of the organ was more or less retained. In one instance, however, an obliterating band passed over the appendix at about its middle, producing an egg-shaped cyst (Fig. 3).

The contents of five of these cysts were mucoid in character, while the contents of the other two were serous. Both of these latter specimens were associated with a marked thinning of the wall, as is frequently found in other hydropic conditions (Fig. 4). In both specimens also there was complete occlusion of the lumen. Indeed, it would be difficult to understand how a fluid of a serous nature could be retained in case the lumen were patent.

The microscopical picture of this condition seems to vary according to the length of time the process had been going on, the presence of complete or partial occlusion of the lumen, and to the nature of the contents. The epithelium lining the appendix varies. Many of the cells may be greatly swollen, due to an increased amount of mucin contained within the cell body (Fig. 5). This can be rendered strikingly prominent by the use of the mucicarmin technic. The increase of these goblet cells would seem to be a fairly constant phenomenon in the formation of an appendicular mucocele.

In cases where the appendix is greatly dilated, forming a cyst under considerable pressure, the mucosa becomes thinned out. It loses the tubular arrangement of its glandular structure and the cells become flattened. A diminution of the lymphoid tissue was found in all the specimens varying with the degree of dilatation. The connective tissue present varied with the amount of inflammatory reaction which had taken place and with the degree of tension to which the wall had been subjected. The muscularis mucosa in the earlier and smaller dilatations may be hypertrophied, but later as the size of the cyst increases it atrophies and disappears. With this increase in pressure the muscular coats atrophy, leaving only a thin wall of connective tissue. In my specimens, the longitudinal coat disappeared before the circular layer of muscle fibres. None of the coats showed an infiltration of any type except when complicated by an acute infection.

SUMMARY.—Cystic dilatations of the appendix are not infrequently encountered. True hydrops of the appendix is by no means as frequent in this organ as other types of cystic dilatation. This condition of hydrops is constantly accompanied by a complete obliteration of the lumen. Bands, adhesions, and other obliterative lesions apparently play a very important part in the production of these cysts.

The author would here express his thanks to Doctors C. W. McGavran, John W. Means, and V. A. Dodd for the use of their material and to Doctor Jonathan Forman for assistance in the collection of specimens and many valuable suggestions during the progress of this study. He is also indebted to Doctor C. Claron Hugger for the photographs.

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REMARKS ON TYPHOID SPINE

WITH REPORT OF A CASE

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Case Report.—The patient was a man thirty years of age, who had never been ill until taken with typhoid fever, February 7, 1916. Widal positive. Fever continued for five weeks. Highest temperature was 103°. May 1, thereafter, after commencing work as a book-keeper, he complained of stiffness in his back. His feet seemed heavy and he was unable to lift them readily. When getting on a car he was obliged to pull himself up by his hands. Articles that he could easily handle before he was sick he found very heavy, and when trying to lift them he complained of pain or a kink in his back. He was unable to lift his ledger from the safe on to his desk.

On June 10 he came home from work complaining of headache and a terrible pain in the small of his back. His temperature was 100° F. During the following week the pain continued, while his temperature varied between 100° and 102°. In the second week his temperature reached 103° and he complained of severe pain below the right costal arch, and here a pear-shaped body could be felt which was very sensitive to pressure. In the third week the pain in the gall-bladder and the fever gradually disappeared, but the pain in his back continued.

During this time he was confined to the bed and could not raise himself into an upright position, but had to turn on his side and slide out. The pain was situated primarily in the lumbar region and was often like the stabbing of a knife. Later it seemed to localize in the iliac crests, first on one side and then on the other. It was brought on by any motion transmitted to the spine, such as turning in bed or in making an effort to rise. The pain was spasmodic in character, at times lasting but for a moment or two and then again continuing intermittently for half an hour or half a day. If he sat up he was obliged to place his hands on his hips or knees or on a table for support.

During these attacks the pain would often extend down the front of his thighs, when the muscles would be suddenly contracted, the thighs drawn up, and the knees flexed. During other attacks the pain would extend along the posterior region of the thighs, then the limbs would be extended and the toes turned down, toward the sole. At times these forcible contractions

would be in one leg and then again in the other and then perhaps in both.

One-eighth to one-quarter grain of morphine was required once or twice a day, in order to make the condition of the patient bearable. If the patient kept entirely still, lying quietly upon his back, the pain was relieved. There was no disturbance of sensation, either tactile or for heat or cold. The patellar reflexes were slightly exaggerated. He had trouble in urinating. The catheter was never necessary, but it took him considerable time to get the urine started. He had trouble in moving his bowels, because every effort increased the pain in his back. The spinous processes of the lumbar vertebræ were sensitive to pressure and the spine was rigid.

On July 7 an X-ray picture was taken of his spine with the light focused at about the twelfth dorsal vertebra. The plate shows the fourth and fifth lumbar to be clear and distinct in outline. From this point up to about the tenth dorsal the outlines of the vertebræ are very indistinct and hazy, while the intervertebral cartilages between the second and third lumbar seem very much thinned, especially on the left side.

A diagnosis of typhoid spine was made, and on July 11 a plaster case was applied, with the patient supported in an upright position from the head and arms by a tripod and Sayre's apparatus. At this time the patient could not stand, and had to be carried from the bed to a stool placed under the tripod.

For a few days after the application of the plaster case he seemed greatly relieved, and then the pain returned. He then complained of the motion between the lower lumbar vertebra and the pelvis. The pelvis was not fixed, the case only reaching to the upper part of the iliac crests. He also made complaint that the case was too loose.

On August 3 a second case was put on, rather snugly, and brought down far over the iliac crests. Relief was immediate. On August 17 and 18 he sat up in a chair, and on August 19 walked across the room. August 20 he complained of pain in his back and across his hips, this continued for three or four days. He was then kept in bed for ten days, after this he sat up each day and had no further pain.

On September 17 he went downstairs and came back without assistance. September 20 he went out of doors.

On October 13 he had gained so much in weight that the case was interfering materially with his breathing, and it was removed and a new case applied.

He had had no pain since August 24, and on December 1 went to work, having no discomfort of any kind, feeling strong and well and able to walk miles.

On February 10 the case was discontinued. At this time a second X-ray was taken, which showed the vertebra much more distinct in outline, but a thinning of the intervertebral cartilages between the twelfth dorsal and first lumbar and between the first and second lumbar.

The condition of typhoid spine was first brought to the attention of the profession by Virgil Gibney, in 1889.

John B. Murphy, in *Surgery, Gynæcology and Obstetrics,* for August, 1916, in an article on bone and joint disease, the result of typhoid fever, states that in 452 cases of typhoid bone lesions the spine was affected in 108. In 533 typhoid bone lesions, the bones of the head were implicated 22 times, spine 110, thorax 142, upper extremities 57, lower extremities 83, multiple bones affected 19 times.

The ribs, tibia and spine represent 70 per cent. of all cases. In the spinal cases the cervical region was involved in one case, dorsal in 8, dorsolumbar 10, lumbar 59, lumbosacral 6, and sacral 4. There was deformity in 17 out of 59 cases.

In the great majority of cases of typhoid spine, the first symptom of importance is pain in the back, and in more than one-half of the cases the pain is situated in the lumbar region. The pain is greatly increased by motion and is often spasmodic. The abdominal muscles may be implicated but more frequently those in the lower limbs are affected. There is frequently a girdle-like sensation about the body and there may be hyperæsthesia of the skin. The pains often radiate to the iliac crests, groins, or down the limbs. There may be incontinence or an inability to empty the bladder. Incontinence has occurred in one-third of the cases. Typhoid spine should be differentiated from lumbago, spondylitis deformans, tuberculosis of the spine and tumors of the vertebræ.

Among the important considerations in the diagnosis of typhoid spine are the following:

The patient has had an attack of typhoid fever. The pains are root pains. The spine is rigid and the spinous processes of the affected region sensitive to pressure. The gall-bladder is often infected and fever is frequently present.

The condition of typhoid spine may make itself manifest during the attack of typhoid fever or a few weeks afterwards or even some months following the attack.

Lumbago is to be differentiated by the facts that the pain and stiffness are confined to the lumbar muscles. The condition is transient, but likely to recur. There is an absence of fever and the pain is relieved by heat and antirheumatic remedies. In lumbago the pains are muscular.

Spondylitis deformans usually occurs in men and especially in those who have performed hard manual labor. There is an absence of fever, the condition is slowly progressive. The patients are usually past middle life. There is often kyphosis, which may involve the entire spine. The spine is more or less rigid and other joints are frequently involved, such as the shoulder and hip and those between the ribs and vertebræ. The latter condition may interfere with respiration. Enlargement of the transverse and articular processes can often be demonstrated by the X-ray.

Tuberculosis of the spine is most frequent in children and young adults. It may follow an injury. The patients have a characteristic gait of careful locomotion with rigid spine. There is often hectic fever, with night sweats, general weakness and wasting, pain in the spine and later kyphosis.

Tumors of the spine, excepting metastatic growths, are extremely rare. Two or three years following excision of the breast for carcinoma, metastasis to the vertebra producing symptoms not unfrequently occurs. These growths produce most agonizing root pains, with marked rigidity of the spine and sensitiveness of the spinous processes. The slightest motion transmitted to the spine causes unbearable pain. The important point here in the diagnosis is that the patient has or has had a malignant growth.

Pathological Anatomy.—From a reading of the literature of typhoid spine and from the study of my own case, I feel confident that there is in this condition an acute infection of the periosteum and bone, an acute osteoperiostitis.

This infection, followed by inflammation and softening of the vertebra, may lead to a crushing of the bone or bones by the superincumbent weight of the body. At the same time as the result of infiltration, softening and pressure, the intervertebral cartilages may become thin and partially disappear.

In 9 necropsies, Quincke found typhoid bacilli 8 times in the marrow of the ribs and once in the bones of the extremities.

Fraenkel examined the marrow from the bodies of the vertebræ in 10 cases, and from each typhoid bacilli were cultivated.

In the treatment, the patient should be given considerable quantities of fresh water, in order to flush and in so far as possible wash the infection out of the system. In some cases, drainage of the gallbladder may be necessary. The second indication is to put the patient at rest, after thoroughly immobilizing the spine in extension. Early immobilization relieves or lessens pain, prevents deformity, and tends markedly to shorten the process of inflammation by preventing irritation and injury.

TRANSACTIONS
OF THE
PHILADELPHIA ACADEMY OF SURGERY

Stated Meeting, held February 5, 1917

The President, Dr. Charles H. Frazier, in the Chair

SCAPULOHUMERAL AMPUTATION FOR GAS BACILLUS INFECTION

Dr. Nathaniel Ginsburg presented a patient who was admitted into the Mt. Sinai Hospital, March 22, 1916, with a traumatic amputation of the left arm about 7 cm. from the shoulder-joint. The extremity had been accidentally introduced into a knitting machine, which caused the injury. Upon admission the patient was immediately taken to the operating room, and disarticulation of the left shoulder-joint was performed. Extensive laceration of the soft tissue about the remains of the shaft of the humerus precluded any attempt to save much of the extremity. The wound was thoroughly disinfected by mechanical cleansing, and by the application of iodine to the lacerated tissues. The shoulder flaps were loosely sutured and a rubber drainage tube, introduced into the glenoid cavity, emerged at the lower angle of the wound.

Thirty-six hours after the amputation, the patient's temperature rose to 105°, accompanied by a rapid and thready pulse of 132. The wound discharge was foul, of the characteristic odor of gas infection, and the flaps were discolored by beginning gangrene. On the following day the shoulder flaps were black, with foul odor and profuse discharge from the wound. The wound was completely opened, exposing the glenoid cavity, bubbles of gas discharging freely at this time. The skin over the entire left chest was discolored and crepitant. Cultures from the wound showed the presence of the *bacillus aerogenes capsulatus* and the tetanus bacillus.

Irrigation of the wound with a fifty per cent. hydrogen peroxide solution alternating every two hours with a 1-4000 bichloride solution was begun. Extensive necrosis took place, resulting in total loss of the flaps enclosing the glenoid cavity, and spread dorsally until the entire surface of the scapula was exposed, as though it had been cleared by a dissecting-room scalpel.

On April 10, nineteen days following the injury, excision of the

scapula was performed, employing nitrous oxide and ether anæsthesia, with practically no bleeding in the wound. He received daily injections of 10 c.c. of antistreptococcic serum, on April 11, 12 and 14. The wound continued to discharge profusely—however, healing over sufficiently to allow the patient to be discharged from the hospital on April 27, when he was referred to the Out-Patient Department for further treatment. Now the denuded surface has completely healed, and the patient has returned to work.

GUNSHOT WOUND OF THE THIGH: GAS BACILLUS INFECTION

Dr. Nathaniel Ginsburg presented a patient who had received a load of bird shot, at close range, into the femoral region of the right thigh, on October 12, 1916. He was admitted into the Jewish Hospital one hour later with a large, punched-out wound, corresponding to the saphenous opening, about four inches in diameter and involving the entire thickness of the thigh in this region. The patient was considerably shocked, with rapid and feeble pulse, and presented evidence of the loss of considerable blood. He was bleeding freely upon admission, the hemorrhage being controllable only by gauze packing introduced into the wound. Fifteen hundred units of tetanus antitoxin were injected and the wound was thoroughly cleansed with pure tincture of iodine. The femoral sheath, with the visible pulsating femoral artery, was thoroughly exposed and had miraculously escaped penetration by the shot. The long saphenous vein and the superficial and deep external pudic arteries and the obturator vessels had apparently been opened by the wound inflicted. The X-ray examination the following day (October 13) showed a great number of small shot embedded in the thigh against and surrounding the obturator foramen. There were numerous shot scattered in the lower gluteal region. In the evening of this day, the foul odor, characteristic of gas bacillus infection, attracted attention and an examination of the wound revealed gas bubbles with crepitation of the surrounding tissue. Dr. David Riesman, who saw the patient, concurred in the diagnosis of gas bacillus infection.

Under nitrous oxide anæsthesia, a fenestrated rubber tube was introduced into the wound, passing completely through the adductor region of the thigh, and irrigation was begun, employing a fifty per cent. hydrogen peroxide solution, alternating with a solution of Bulgarian bacilli every two hours. The infection was apparently confined by the intermuscular septa of the thigh, which enclose the muscles of the median osteofascial compartment, and did not spread beyond this

region. Extensive necrosis of the muscles corresponding to this area took place.

On October 14, two days after admission, continuous irrigation of the wound with Dakin's solution was begun, the hydrogen peroxide solution being discontinued. The patient was extremely toxic, and intravenous injections of sodium bicarbonate solution were administered daily. Multiple incisions were made over the internal and posterior surfaces of the thigh, opening up the muscular spaces through which drainage was established.

Improvement slowly took place, large masses of necrotic material being removed from the wound and counter openings. On October 21, close application of electric light to the wound, without dressings, was maintained. In view of the fact that the process was now limited, and the patient's condition much improved, irrigation of the wound with a fifty per cent. peroxide of hydrogen, followed by a 1-8000 solution of nitrate of silver, was substituted for Dakin's solution.

The patient was discharged from the hospital November 6, 1916, with loss of the upper portions of the adductor and gracilis and pectineus muscles, and with slight discharge from the wound corresponding to the site of his injury. Numerous shot have been discharged from his gluteal wound since he left the hospital, but most of the bird shot still remain in his body.

Recovery in these two cases can be attributed to early and free drainage which was established, with the continuous irrigation of the wounds.

COMPOUND FRACTURE OF THE PATELLA

Dr. John H. Jopson presented a stout woman, fifty-six years of age, who was admitted to the Presbyterian Hospital in September, 1916, with a bad laceration of the face and a compound fracture of the patella, the result of having been struck by a street car. She was transferred to the operating room almost immediately. Examination of the knee disclosed an irregular wound over the patella, about one inch in length, running transversely. Through this could be palpated a comminuted fracture of the bone, which was broken into many fragments, and the finger passed directly through it into the knee-joint. The patient was etherized, and the entire region of the knee prepared for operation. The preparation consisted in cleaning the skin with benzene, alcohol and tincture of iodine. The wound was enlarged by lateral incisions, which were carried downward and outward to the condyles of the femur. The joint, when opened, was thoroughly

washed out with a sherry-colored solution of tincture of iodine in water. The patella was broken into probably a dozen fragments, and two or three small detached fragments were removed. The aponeurosis had been lacerated over the bone and torn down toward the external condyle. It was brought together with mattress and interrupted sutures of chromic catgut. Two rubber drainage tubes were inserted in the outer angle of the wound, one extending into the joint, the other to the opening in the joint capsule. The skin wound was sutured except for the drainage track and the traumatic wound, which latter was drained by a piece of rubber tissue. The leg was dressed on a posterior splint and the patient given antitetanic serum.

The convalescence was uneventful. An X-ray taken after operation showed good approximation of the fragments. The splint was removed after four weeks and the patient left the hospital on November 1. There was then about one-third the normal amount of flexion present in the knee and she was able to walk on crutches. She has now regained very fair use of her knee, is able to bear her weight on it, and has good range of motion, flexion being possible to a right angle, and still improving.

This case illustrates among other things the method of treatment of compound fractures of any variety which Dr. Jopson has found most efficacious, namely, immediate transference to the operating room, etherization, sterilization as if for primary operation, followed by cleansing of the wound—sterilization, the introduction of drainage and whatever other measures may seem indicated. Since adopting this plan his results in the treatment of compound fractures have been vastly improved, and severe infections are a rarity.

Compound fracture of the patella is an unusual injury in civil practice. Of twenty-six recent fractures of the patella operated upon by him, this was the only instance in which the fracture was compound. This series was operated without mortality and without joint infection. Stimson has emphasized the fact that patellar fractures are generally compound by reason of external violence, except in those instances where refracture occurs after operation, and where the scar or the skin is tightly adherent to the surface of the bone. In such instances indirect violence may result in simultaneous fracture of the patella and tear of the soft parts covering the bone.

Dr. Nathaniel Ginsburg gave the history of a compound fracture of the patella which was operated upon by him on August 22, 1912, in the Philadelphia Polyclinic Hospital.

The patient was a fireman on a railroad engine, who fell from the

tender, striking on the right patella. He was operated upon immediately on his admission to the hospital, and the patella was found to have been fragmented into four pieces, with a wound communicating with the interior of the joint. At operation, one fragment was found lying free in the joint cavity, which was removed, and another small fragment, which could not be satisfactorily placed in relation to the other pieces of the patella, was excised. The joint was irrigated with a 2 per cent. formalin solution, followed by sterile water, and the remaining fragments were apposed by a bronze wire passed through the ligamentum patellæ below the quadriceps extensor tendon above. The capsule was sutured as well as the lateral ligaments, the joint being closed without drainage. The leg was immobilized by a posterior splint, in addition to traction, employing twenty pounds of weight.

On the day following the operation, the knee-joint was aspirated and about 200 c.c. of serosanguineous fluid were removed, and 15 c.c. of a 2 per cent. formalin-glycerin solution were injected. The patient was discharged from the hospital on September 28, with good union of the patella. The highest temperature during his stay in the hospital was 99°, and the pulse-rate never rose above 98.

He has been unable to trace the patient since his discharge from the hospital, but there is every reason to believe that he has a good functional knee-joint, since he had a satisfactory operative recovery, and no infection resulted following the injury.

OLD REFRACTURE OF THE PATELLA, WITH SUPPURATIVE ARTHRITIC EFFUSION, AND RESECTION AND TRANSPLANTATION OF THE LOWER FRAGMENT

Dr. Nathaniel Ginsburg presented a man who was admitted into the Jewish Hospital, September 7, 1916, and discharged December 22, 1916. Four months previous to his admission, the patient sustained a fracture of his right patella, which was sutured in another hospital, the fragments not having been wired. He tripped over a curbstone, and fell to the ground, striking his right knee, and sustaining a refracture of the patella, on September 7, 1916. Examination showed a transverse fracture of the right patella, with about five centimetres' separation of the fragments. On the following day a sudden rise of temperature occurred, which reached 103° September 10, seventy-two hours after admission.

On September 11, an examination of the knee-joint suggested the presence of a purulent effusion. The joint was aspirated, and 90 c.c. of pinkish purulent fluid were withdrawn; and 14 c.c. of a 2 per cent.

formalin in glycerin solution were injected. The temperature immediately dropped to $99^{2}/_{5}°$.

The day following the aspiration of the joint, a large submuscular abscess of the lower third of the right thigh was incised, employing local anæsthesia. This infection was associated with the purulent joint effusion, and probably was an extension of the same. The temperature subsided to normal thirty-six hours following drainage of the thigh abscess.

Longitudinal traction was applied to the injured leg upon his admission into the hospital, and was maintained until the open operation upon the patella was performed. Drainage from the thigh wound and from the needle puncture wound into the joint continued for some weeks. On October 25, about seven weeks after his admission into the hospital, his wounds had completely healed. It was now deemed advisable to attempt to bring the patellar fragments together. The operation was performed during one of the clinics for the physicians attending the Clinical Congress of Surgeons then meeting in Philadelphia.

Under gas-ether anæsthesia, a vertical incision was made over the right patella extending from the quadriceps extensor tendon above to the tubercle of the tibia below, and the interior of the joint was exposed. There was considerable capsular and aponeurotic thickening with fibrous induration of the blood-clot which existed between the two fragments. Both fragments were immobile, and could not be apposed in the slightest degree. The joint cavity above the line of fracture was considerably diminished by the firm application of the upper fragment to the femoral surface, owing to the contraction of the quadriceps extensor muscles and the lateral ligaments.

The periosteal attachment of the ligament of the patella was chiselled off the tibia, carrying with it a small fragment of cortical bone. This did not lessen the difficulty, since the lower fragment remained immovable, owing to the induration and diminished elasticity of the patellar capsule and the lateral aponeurotic expansion. The lower fragment was completely excised and lifted out of the wound. The wound clot was dissected, and, after freshening the fracture surfaces, the excised fragment was brought in contact with the upper fragment and held there by a phospho-bronze wire suture passed through the patellar capsule. The lower fragment was fixed on a higher level by interrupted chromic catgut sutures to the aponeurotic expansion from which it had been dissected, and the lateral ligaments and patellar capsule of the knee-joint were also sutured by interrupted

chromic catgut sutures. The joint was immobilized by a plaster casing extending from the upper thigh to the lower leg, which was worn for four weeks.

With the exception of some slight superficial wound discharge, convalescence was uninterrupted and the patient was dismissed from the hospital on December 22, 1916, with union of the patellar fragments and sufficient flexion and extension of the leg to allow him to act as an orderly in the hospital. The X-ray examination of both knee-joints shows the superior position with relation to the femoral condyles occupied by the injured patella.

Dr. John H. Jopson said that some time ago he showed before the Academy a case of old fracture of the patella in which there had been much difficulty in approximating the patellar fragments. A plastic operation on the quadriceps tendon was performed, and an elevation of the tubercle of the tibia after the method of von Bergmann, after which the fragments could be brought in apposition and wired. Firm union was secured. Dr. Ginsburg's method amounts to a free transplantation of the lower fragment and the result is excellent. He would much prefer this method to the use of a bone inlay as suggested by Albee, as he believes convalescence would be much shorter and the resulting union stronger.

CHRONIC PERFORATING ULCER OF THE SMALL INTESTINE, INVOLVING THE BLADDER WALL

Dr. Geo. Erety Shoemaker presented a woman fifty-three years of age, who had been operated upon by him December 4, 1916, for the relief of ulcer and partial obstruction of the small intestine, chronic appendicitis, chronic cholecystitis. The patient was very stout and for a number of years had had pain and abdominal distention with occasional nausea and vomiting without definite localization as to origin. She had been in the Medical Wards of the Presbyterian Hospital twice under suspicion of pyloric ulcer. Definite symptoms associated with that condition were, however, wanting. The obscure attacks continuing, she was admitted to the reporter's service for exploration on recommendation of her physician.

Patient had formerly weighed more than 200 pounds, but had lost 47 pounds, and claimed to be unable to eat general diet without bringing on attacks of severe abdominal cramp-like pain, with difficulty in moving the bowels. There was no history of jaundice; the pains never went to the right shoulder and were never located in the gall-bladder region. They had only lately been in the right lower quadrant,

shifting to the umbilicus. Repeated previous gastric analysis had shown low total acidity, low free hydrochloric acid, contents usually alkaline; there was no food retention. The X-ray studies had resulted in a diagnosis of pyloric ulcer by the röntgenologist, but there was no food relief, no pain late after food ingestion. There was now no leucocytosis and no jaundice. Shortly after admission to the hospital, a sharp attack of generalized abdominal pain occurred with persistent vomiting. Lavage of the stomach brought brownish material with a fecal odor. The bowels moved freely immediately afterwards and there was no further vomiting. The condition was now evidently one of partial obstruction. No pelvic lesion was present except a very small movable nodular mass in the region of the right ovary, which was not accounted for. There was frequent urination and much bladder irritation. The thighs and vulva were inflamed and incrusted from urinary contact. There was no incontinence. Because it was necessary to explore both the upper and lower abdomen, the incision was made to the right of the navel and extended upward and downward as required. The gall-blader contained more than one ounce of bile; was compressible, moderately adherent, its walls a trifle thicker than normal and of a dull brown color, which indicated a low degree of chronic inflammation. No stones could be felt. The pylorus was thoroughly exposed and palpated, but no thickening or other evidence of disease could be demonstrated. There were no adhesions. The appendix was long, passed behind the cæcum, and had no meso. It was removed after splitting the outer mesocolon, cutting off the base first and gradually working down to the tip. Adhesions in the neighborhood had formed a well-defined Lane's kink which was released. A congenital fold of peritoneum passed downward from the root of the appendix to the pelvic wall at the insertion of the infundibulopelvic ligament. That was ligated and incised. Further exploration revealed about two feet from the ileocæcal an angulated knuckle of small bowel, infiltrated over an area of an inch or more in diameter. There were no neighboring adhesions. The bowel was separated and brought into the wound which produced a fistulous opening. The intestine was larger above than below the site of partial obstruction. The mesentery was thickened, but not hard, near the insertion into the bowel. About 8 inches of small intestine was resected, the ends being burned off with the cautery and turned in with catgut, afterward being covered with Lembert suture of celluloid linen. Side-to-side anastomosis was then performed by suture. The infiltrated point of the bladder showed excavation which did not at this time perforate the mucous membrane, though

it may at some time have done so. The diseased area was excised, the bladder wall sutured with two rows of chromic catgut. An abdominal cigarette drain was introduced near the site of the intestinal anastomosis. A retention catheter was placed in the urethra. There was no post-operative vomiting, no distention, intestinal gas passed freely. Bowels were moved by glycerin enema. There was a few drachms of purulent brown fluid at the drainage site by the third day; the drain was removed at this time and was not replaced. No gas and no fæces escaped at any time. The external irritation from the urine rapidly cleared up.

The convalescence was somewhat stormy due to the long-standing gastric catarrh with flatulence. The anastomosis never leaked; the wound healed solidly while in the hospital. Normal bowel movements were readily secured. The patient is now doing well, January 17, six weeks after operation. Cystoscopy by Dr. Laws shows bladder normal.

Laboratory Diagnosis.—Dr. Pfeiffer. Inflammatory infiltration and ulceration of bowel and bladder.

CONGENITAL PYLORIC STENOSIS

Dr. Damon B. Pfeiffer presented a specimen of congenital pyloric stenosis. The patient was a girl, aged four weeks, the only child of healthy parents. At birth the baby weighed 7 pounds 13 ounces, and was apparently normal. For the first week the child took the breast and showed no digestive disturbances. During the second week she began to vomit occasionally. Various milk formulas were tried without effect and the vomiting grew worse while the baby lost weight rapidly. The bowels moved scantily. In the fourth week Dr. Charles A. Fife was called in consultation by the attending physician, Dr. George A. Parker of Southampton. Visible gastric peristalsis could not be observed at times, but no epigastric tumor was palpable. The child displayed evidence of ravenous hunger, taking food eagerly and sucking its thumbs. With the diagnosis of hypertrophic stenosis of the pylorus, the patient was referred to the Abington Memorial Hospital, for operation. The weight by this time was barely four pounds. The pulse was exceedingly thin and weak and the temperature subnormal.

Under ether anæsthesia, a posterior gastrojejunostomy was made without special difficulty. Hypodermoclysis was given during the operation and the patient left the table in good condition. She vomited once the following day and the stomach was washed out, a small quantity of biliary material being obtained. Feedings of whey were begun.

The next day the baby showed evidence of excessive weakness and died a few hours later.

At postmortem the peritoneum was everywhere glistening and showed no evidence of peritonitis. The gastrojejunostomy was mechanically satisfactory. The pyloric canal for a distance of about an inch was tightly constricted, as had been observed at operation, by a thickened muscularis measuring 6 mm. in depth at its thickest part. There was no apparent œdema. The longitudinal incision through this part of the muscularis was made after removal of the specimen and shows beautifully the distinctness of the separation of the muscularis from the submucosa and the elasticity of the latter, thus illustrating the ease and effectiveness of a Rammstedt procedure which was considered but not practised in this case. It shows also the sharp limitation of the muscular thickening to the gastric side of the pylorus, an important point to observe in performing the Rammstedt operation, because of the ease with which the duodenum may be opened.

The case illustrates the fact which has been pointed out by Holt, Downes and others, that sudden collapse may occur in these weakened infants with or without relief of the obstruction, and shows the advisability of resorting to surgical measures at an early period.

ILLUSTRATION OF A DISSECTION SHOWING A UNIQUE CONCEPTION OF DIRECT INGUINAL HERNIA

Dr. P. G. Skillern, Jr., presented the specimen shown in Fig. 1.

SURGICAL EXPERIENCE AND SURGICAL KNOWLEDGE

Dr. Joshua Edwin Sweet delivered the *Annual Oration* before the Society—the title of his address was as above, and the address will be found on page 673.

FIG. 1.—A unique exposé of direct inguinal hernia, chanced upon in the dissecting room of the University of Pennsylvania. On stripping the general layer of parietal peritoneum backward from the anterior abdominal wall in quest of the deep epigastric artery this finger-like hernial sac was revealed with its tip in the hernial orifice. Its connection with the general layer of parietal peritoneum was exactly like that of the finger of a glove to the rest of the glove. To show the hernial orifice the sac was drawn somewhat backward. Hesselbach's triangle is well shown, with the hernial orifice near its base.

TRANSACTIONS
OF THE
NEW YORK SURGICAL SOCIETY

Stated Meeting, held January 8, 1917

The President, Dr. Charles N. Dowd, in the chair

REPAIR OF LARGE INCISIONAL VENTRAL HERNIÆ BY PEDUNCULATED FLAPS OF FASCIA

Dr. Charles L. Gibson presented the following cases from the First Surgical Division (Cornell) of the New York Hospital:

Case I.—Miss F., thirty-four years of age. In February, 1912, was operated for suppurative appendicitis. In April, 1913, was operated by Dr. Gibson for intestinal obstruction due to adhesions. Several feet of gangrenous lower ileum were resected and a side-to-end anastomosis made with the cæcum. There was an active peritonitis. Wound was left open in part and convalescence was effected only after marked suppuration of the abdominal wall.

On February 24, 1914, repair of ventral hernia was undertaken. After freeing the adhesions and refreshing the edges of the muscular and fascial layers it became evident that the edges could not be approximated even with undue tension. No other means of closing this large gap seemed available excepting by inserting a wire filigree. It was then determined to make releasing incisions through the outer border of the anterior sheath of the rectus on either side (Fig. 1). The free edges then could be readily approximated without undue tension in midline. The wound healed kindly. It is now nearly three years since operation and the abdominal wall is maintaining its integrity and the patient is able to perform severe muscular exertions without discomfort.

Case II.—Nicholas W., forty-one years of age. Operated February 9, 1915, for cholelithiasis and stone in common duct. There was a severe infection of the abdominal wall, resulting in much sloughing, and when the wound closed there was a protrusion through the scar nearly the size of an adult head (Fig. 2).

On October 9, 1915, a similar operation as described above (Case I) was performed. There was a mild degree of suppuration, apparently due to the reopening of the sinus connecting

with the common duct, as for a while bile was discharged freely. Notwithstanding this infection the wound healed kindly and he was discharged November 17, 1915. At present the wound remains solidly healed and there is no sign of hernia (Fig. 3).

CASE III.—Lawrence P., twenty-two years of age. Operated June 12, 1913. Laparotomy through upper right rectus for general peritonitis believed to be due to acute perforation of the stomach. Cause, however, was found to be an acute appendicitis. There was considerable infection of the abdominal wall resulting in much sloughing, and when patient was discharged August 4, 1913, there was a hernial protrusion through the scar size of two fists (Fig. 4).

On April 3, 1916, a similar operation as described above was performed. Here again there was a mild infection, but notwithstanding it the fascial edges united well and he is now, nine months after operation, in very good condition. Re-examination shows a perfectly firm scar.

OSTEOMYELITIS TREATED BY CARREL IRRIGATIONS FOLLOWING OPERATION

DR. GIBSON also presented the following cases:

Arthur H., eleven years of age. Operation October 23, 1916, for osteomyelitis of femur with removal of sequestra. The Carrel treatment was started seven days after operation and continued for twenty-five days (October 30 to November 25), when the wound having healed down to a narrow sinus, the last drainage tube was withdrawn. Discharged November 28, 1916.

At present the wound is firmly healed without any sinus.

Sylvanus C., twenty-one years of age. Extensive old osteomyelitis with necrosis of the upper third of the shaft of the tibia and entire head of the tibia. Sequestrotomy October 16, 1916, removing all the necrotic bone, leaving the head of the tibia only a thin shell. The Carrel treatment was started eight days after operation. To-day the whole wound is solidly healed with the exception of a narrow sinus admitting probe for about 1 inch.

Both these cases responded to the treatment with unusual promptness. There was at first a good deal of mucoid discharge such as is characteristic of all wounds treated by the Carrel method and particularly those connecting with bone. The bacterial count quickly and consistently came down to the zero level (Figs. 5 and 6). At no time did these wounds show the slightest evidence of suppuration. In the last case the result was unusually prompt and favorable. It has been rare, in his experience, that such a complete excochleation of the head of the tibia becomes filled up by healthy granulations and transformed into

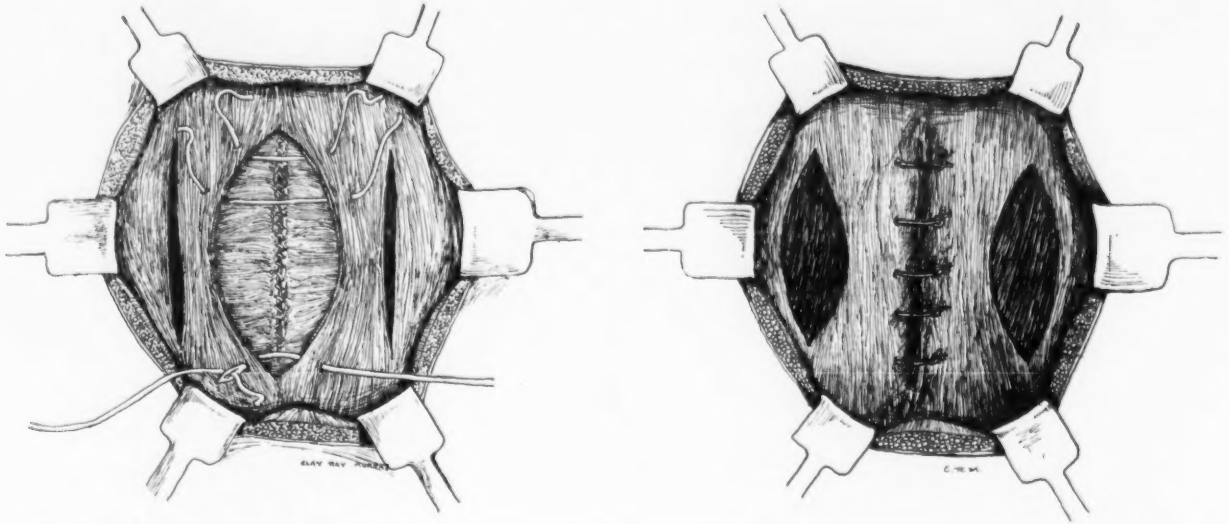


FIG. 1.—Diagrams reproduced from article on "Post-operative Intestinal Obstruction," ANNALS OF SURGERY, April, 1916, vol. lxiii, p. 443.

FIG. 2.

FIG. 3.

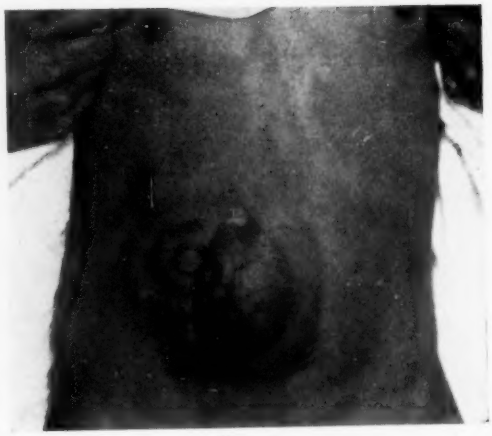


FIG. 4.

bone. These cases usually require secondary or plastic operations to close the bony defects.

DR. H. H. LYLE suggested the desirability of beginning the Carrel irrigations immediately after an operation.

Form 249

NEW YORK HOSPITAL.

BACTERIAL CHART

Name Arthur H. History No.

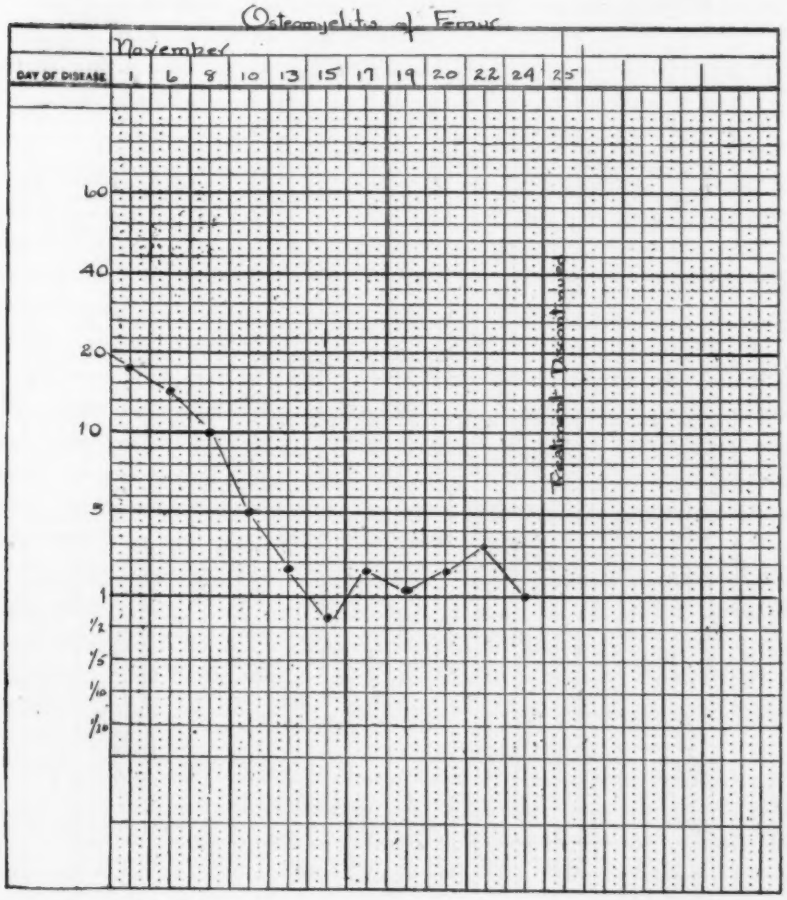


FIG. 5.

DR. HAWLEY said that he had about fifteen cases of chronic osteomyelitis under treatment by the Carrel method, all old and resisting cases. Most of them have been secondary, and perhaps five out of the fifteen are cured, old chronic osteomyelitis following compound frac-

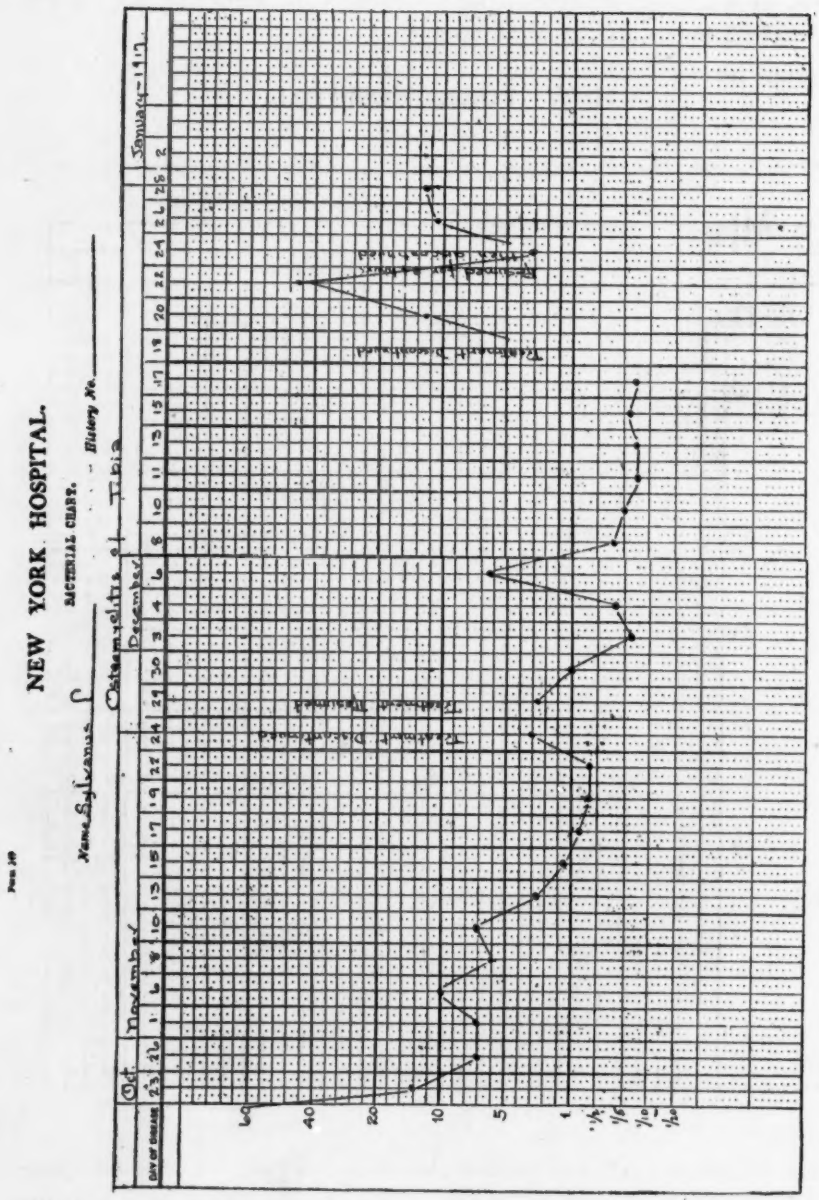

NEW YORK HOSPITAL.
BACTERIAL CHART.
Name Sylvanus C
Osteomyelitis of Tibia
Oct. November December January-1917
Temperature Taken
Temperature Recorded
Pulse Taken
Pulse Recorded
40
20
10
5
1
1/2
1/5
1/10
1/20

FIG. 6.

ture. While it is too early to say what the eventual outcome will be, he could say that under no method of treatment had he seen such fine appearance of the wounds. He had simply been following, as far as he could, what he had seen principally in Chutro's clinic in Paris at the Hospital Buffon, where he saw actual cases of chronic osteomyelitis cured and also a number of cases of septic arthritis.

He had two cases of septic arthritis of the knee which were doing very well. In no case is the septic process advancing; the temperature has dropped; there is no general appearance of sepsis; and the bacterial count has dropped down toward the normal line. He believed that this method was a step forward in the treatment of chronic infections of the bones and joints.

HOUR-GLASS CONTRACTION OF THE STOMACH

Dr. William A. Downes said that about two years ago he presented a case of mediogastric resection for hour-glass contraction in which the immediate result was very satisfactory. At the time the question was raised as to the future condition of these patients in which completed division of the stomach wall had been made with end-to-end suture.

He now presented this same patient and three others upon which the same operation had been performed. The first one had gone three years, the second a little over two years, and the third and fourth only a few months. The result in each case has been most satisfactory, and apparently from recent X-ray plates these stomachs behave very much as do normal stomachs.

Dr. George D. Stewart remarked that he had had some of these cases of mediogastric or segmental resection. Some of the operations were done for hour-glass contraction and some for plain gastric ulcer, because a good many men of wide experience seem to believe that segmental resection was superior to triangular resection or merely excising the ulcerated area.

It had seemed to him that the cases of segmental resection were better in their results than those in which the ulcer only had been excised. Dr. Barber and he had tried to prove or to demonstrate the reason. They did some experimental operations on dogs, and studied them by opening them up afterwards and watching the gastric motility. They studied them by persuading the dog (and a dog doesn't easily lend itself to this persuasion, even in the interest of science) to swallow a bag which was dilated in the stomach. They had some difficulty in getting it in and then getting it dilated. They studied the effect on the motion of the stomach of increasing the size of the bag.

These studies were published in the ANNALS OF SURGERY. The only thing that could be said was that so far as the experiment went, the dogs seemed to do better with a mediogastric resection than with some irregular form, proving that similarity to human action, but the why has entirely eluded them. They could not demonstrate why it should be better.

If anything, their cases seemed to move more regularly, more rhythmatically, when there was a segmental resection than when an irregular resection had been performed.

SPINAL CORD TUMOR

DR. ALFRED S. TAYLOR presented a woman, fifty-five years old, who for ten years had been excessively nervous, but otherwise well and strong. Fourteen years ago she fell from a street car, landing on her back and twisting her neck. The lameness had disappeared in a few days. Three years ago she noticed for the first time a pain in the mid-scapular region to the right of the spine, and this pain has persisted up to the time of operation. Two years ago she stumbled on getting into a car and fell full length.

In the summer of 1915, walking had become laborious and stair climbing very difficult. October, 1915, she developed a burning sensation in the left leg, which gradually spread until it involved both lower extremities.

On November 15, 1915, she waked up with a tight girdle sensation about the abdomen, which has persisted ever since. From that time walking became increasingly more difficult. There appeared in the lower extremities sensations of heat and cold, tingling and numbness. She could not distinguish between hot and cold objects, and could not tell whether her bath was water or sand. There soon developed difficulty in evacuating the bowel, although she had always been regular. The stools were not of constipated character, so that the difficulty was evidently muscular. There also appeared frequency of micturition with delay in starting.

Toward the end of January, 1916, she had a sensation of tight bands about the knees and ankles. About February 1, in attempting to enter a car, her feet would not lift and she fell. A few days later her legs gave out suddenly in crossing a street. From February 14 she had to remain in bed nearly all the time. After February 21 she could not move her legs even in bed.

The patient was a fairly nourished woman of fifty-five years; she was pale, the tongue coated and deeply furrowed; the eyes are normal,

the pupils are equal and react to light; the eyegrounds are normal. Examination of the thoracic contents shows nothing of interest.

The second and third dorsal spines are tender to percussion.

Above the level of the second dorsal segment there are no sensory disturbances, but below it there are irregular areas where it is difficult for her to distinguish between heat and cold and where pain sense is dulled.

Touch is slightly if at all involved. The right lower extremity is from 0.5 to 0.75 of an inch smaller than the left, both above and below the knee. There is marked loss of power in both the flexor and extensor muscles, especially in the right lower extremity. There is marked fibrillary twitching of the thigh muscles.

Reflexes: Wrist and elbow increased. Patellar and tendo achillis greatly increased. Ankle clonus very marked on both sides. Babinski and Oppenheim reactions suggestive.

Ataxia, Romberg symptom, and disturbance of muscular sense in the hands absent. There is slight disturbance of muscular sense in the feet.

Spinal fluid, February 15, 1916: 15 c.c. removed. Pressure was slightly increased. Cells, all mononuclear, were 150 per cu. mm. Globulin + +. Albumin +. Sugar reaction prompt. Wassermann reaction negative.

Blood, February 16, 1916: Anisocytosis moderate. Poikilocytosis slight; white blood-cells, 300 counted; polymorphonuclears, 53 per cent.; transitionals, 1.5 per cent.; lymphocytes, 40 per cent.; large mononuclears, 3.5 per cent.; eosinophiles, 1 per cent.; mast cells, 1 per cent. Blood Wassermann negative.

Röntgen plates of the spine showed nothing of importance.

Operation (February 29, 1916).—Ether. Right hemilaminectomy was done involving the seventh costal and first, second and third dorsal spines. The bone was normal. The dura was slightly thickened. A tumor was felt through the dura, lying transversely over the dorsum of the cord at the level of the second dorsal. The first, second and third dorsal spines were clipped at their bases, pushed over to the left and the corresponding laminæ on the left side removed.

The dura was split in the median line the whole length of the wound.

A small white firm tumor was attached to the dura just to the right of the incision in it. The tumor was removed with the dura at its base.

Another tumor, soft, vascular, dark reddish blue in color, lay to the right side and in front of the cord, apparently beneath the arachnoid. This extended from the lower edge of the first dorsal to the upper edge of the third dorsal and lay mostly in front of the cord, being especially large opposite the second dorsal spine.

The arachnoid was divided by scissors and the tumor carefully enucleated. It was so friable that it came out piecemeal, but was removed completely without damage to the cord to which it was not adherent. The cord had been compressed and pushed backward and to the left by the tumor, being most displaced opposite second dorsal spine. After the tumor was completely removed the cord still maintained its deformed position.

After careful hæmostasis the dura was closed by continuous catgut stitch and the remainder of the wound closed by layer sutures. No drainage was used.

After Course.—Healing was by primary union and the sutures were out on the fourth day.

For about three weeks her general condition was precarious, during which period cystitis with colon bacillus infection, tonsillitis, and a deep-seated pulmonary involvement which could not be made out for a number of days, all occurred. These complications were accompanied by low delirium, loss of sphincteric control, irregular temperature, and irritability.

During this period complaint of pain in the arms and in the wound led him to open it down to the dura to see if a deep infection might be the source of her troubles. The wound was perfectly clean and promptly healed again.

On the fifteenth day the delirium began to clear up and the general condition improved greatly. Thereafter improvement was continuous.

On the twenty-sixth day she sat up in a chair.

On the twenty-seventh day she stood up with some support.

On the twenty-eighth day she took three steps.

On the thirty-sixth day she walked well, sensation had returned to practically normal in both legs, and she returned home.

On July 8, 1916 (4 months 8 days after operation), she walked a mile out in the country.

She now walks about without fatigue and covers five miles or more every day.

The great nervousness, irritability and tendency to worry characteristic of the last ten years have entirely disappeared. There is now very slight increase in the knee jerks, but otherwise there is no remnant of the old symptoms. The right hand is slightly weaker than the left.

The promptness and completeness of recovery were largely due to the removal of the tumor before the complete paralysis had been long in existence.

It is interesting to note that there were two entirely separate tumors

present, quite different in appearance, one attached to the dura, and the second one separated from the first by the arachnoid but lying at the same level of the cord, and lying between the arachnoid and cord but not adherent to the cord.

Pathological Report.—The tumor attached to the dura is an endothelioma. The softer, subarachnoid tumor consisted of cells generally spindle or oval shaped, often taking a concentric arrangement about calcareous (psammoma) bodies of varying size. Some of the cells are more round, contain considerable protoplasm and thus resemble endothelial cells.

CARCINOMA OF THE CÆCUM

Dr. Joseph Wiener presented a man, fifty-one years of age, who was admitted to the First Surgical Service of Mt. Sinai Hospital August 14, 1914. His father had died at forty of pulmonary tuberculosis; his mother had died at sixty of cancer of the breast. One sister had been operated for cancer of the breast three years before.

At the age of ten he had had some intestinal infection, which had kept him in bed ten weeks with diarrhœa and bloody stools. He had married at twenty-one and had five children. After working for two years in a benzine factory he complained of loss of appetite and constipation. He came to this country in 1894, and had obstinate constipation since then. Seven months ago had influenza, and constipation had been more marked since then, necessitating use of purges. Four weeks before admission he noticed that he was losing weight rapidly, from 185 to 134 pounds. Two weeks later he noticed a mass in the abdomen.

Examination showed moderate emaciation, and in the right iliac fossa a hard, freely movable mass, somewhat tender, about two inches in diameter. Rectal examination was negative, but the stools contained a trace of blood.

Operation (August 17, 1914).—Resection of ileum and cæcum, and ileocolostomy for carcinoma of ascending colon. Abdomen opened through a right rectus incision. A hard tumor found in the cæcum about the size of a lemon. The cæcum was mobilized by dividing the outer layer of the mesocolon. The ileum was resected four inches from the cæcum and the ends inverted by three layers of linen sutures. The mesocolon was resected deep on account of the presence of enlarged glands. The colon was resected at the hepatic flexure, the end tied off with a linen ligature, reinforced by two layers of linen sutures. A side-to-side anastomosis was done with Connell sutures of linen. The abdomen was closed without drainage except for the skin. Time of operation fifty-seven minutes. A week later a small fecal fistula developed at the lower angle of the wound. This was cauterized sev-

eral times and the man left the hospital on November 20, 1914, with a healed wound. He had gained 15 pounds in weight.

The pathological diagnosis was carcinoma.

The man was readmitted to the hospital on March 2, 1915, with a fecal fistula, which had closed and reopened several times. Fluid movements came from the fistula, his bowels were loose and his appetite poor.

Operation (March 15, 1915).—Ileocolostomy for fecal fistula. The abdomen was opened through a left rectus incision. A loop of intestine was found adherent to the abdominal wall. A probe in the fistulous tract entered this loop, which consisted of the end of the ileum which had been turned in before the side-to-side anastomosis had been done. It was found impossible to separate this loop from the abdominal wall without entering into the site of the anastomosis. Accordingly the ileum was divided two inches proximal to the anastomosis with the cautery, and the distal end tied off with heavy silk, and the end inverted with two layers of linen sutures. The proximal end of the ileum was crushed with an angiotribe, tied off with linen and the stump inverted with three layers of sutures. A side-to-side anastomosis with linen sutures was done between the ileum, two inches proximal to the inverted end, and the descending colon, just below the splenic flexure. The omentum was then sewed over the area of the anastomosis as well as over the inverted end of the ileum and over the end of the ileum adjacent to the former anastomosis. The abdomen was closed with drainage. It was hoped that the old fistulous tract would gradually heal without extensive removal of the gut, which the man could not have stood at the time of this operation. In five weeks the fistula was closed and the patient left the hospital with both wounds healed. Since then there is occasionally a very slight discharge for a few days at the site of the old fistula. His general condition is very much improved and he has gained 33 pounds. He recently walked ten miles in one day. Two and a half years have elapsed since the first operation and there is no sign of any recurrence, in spite of the fact that enlarged glands were found in the mesocolon at the first operation.

REAMPUTATION OF FOOT BY THE METHOD OF PIROGOFF

Dr. Ellsworth Eliot, Jr., presented a young man who was seen by him for the first time April, 1916, more than two years after an accident in which his foot had been crushed in a freight car collision and during which time he had been treated by various surgeons, first with amputation of the toes followed by amputation of the metatarsals, finally leaving a Chopart's stump. The anterior extremity of this

stump presented a granulating area the size of a half dollar over the cuboid bone, with extensive cicatricial tissue extending backward on both the inner and outer aspects in which were several smaller areas of ulceration the size of a pea. The sides and plantar surface of the heel were covered with normal skin in sufficient quantity to provide adequate flap material for a Syme's but not for a Pirogoff's amputation. Several unsuccessful attempts at skin-grafting had been made, the patient having been anæsthetized eight different times.

Notwithstanding probable failure, it seemed worth while to make the attempt to secure healing of the stump by the removal of the cuboid and scaphoid. The subsequent sloughing of the cicatricial tissue, which formed in part the flap material, left an ulcer of practically the same size and position as existed prior to the operation. Three different procedures were then considered; a Syme's amputation, a supramalleolar amputation and some form of plastic operation for covering the denuded stump, leaving its length intact. Three or four very satisfactory results after Pirogoff's amputation led to the selection of the last named procedure. After etherization a pedunculated flap was dissected from the opposite calf and carefully approximated by suture to the ulcerated area of which the edges and surface had been freshened. The legs were then immobilized by plaster of Paris applied to both knee-joints and to the non-affected ankle. The distance between the legs was kept constant by the incorporation in the plaster of basswood splints both in front and behind the knee-joints and, similarly, by longer splints extending from the knee of the stump side to the opposite ankle. Of these two latter splints, the posterior served as a support for the heel of the stump side, which, through flexion of the knee-joint above, was placed in close contiguity with the calf just below the point of the attachment of the pedicle of the flap. Immobilization was continued for four weeks when the pedicle was divided in two stages separated by an interval of four days. It is interesting to note that during this time the patient experienced no discomfort and that all joint stiffness had disappeared within a week after the immobilizing apparatus was removed. The rather prolonged time of immobilization before the division of the pedicle of the flap seemed to be indicated by the fact that the tissue to which the flap was to be applied was, even under normal conditions, sparsely supplied with blood and that its complete vitalization would require a correspondingly long interval. A small ulcer at the point of junction of the flap and tissue of the heel which healed very slowly seemed to justify this conclusion.

It is interesting to note the excellent flexion and extension of the ankle, of which the patient is capable. This is practically normal and

there is no tendency for the heel to assume a position of hyperextension due to unantagonized contraction of the tendo achillis, so frequently seen after a Chopart's amputation or, in fact, after any amputation through the foot in which the ankle-joint is left intact where the flexor tendons are divided. This unfortunate sequel which renders the stump practically useless as a means of support may frequently be avoided, as in this instance, by the suture of the divided ends of the flexor tendons to the anterior extremity of the dorsal surface of the remaining tarsus, thus providing a new point of attachment.

A question worthy of discussion apart from the question of the flap is the relative value, from a functional standpoint, of a stump of this character with a special boot and such a stump as may be secured by a supramalleolar amputation with an artificial leg. He was inclined to believe that the present stump will prove more satisfactory.

CONGENITAL TORTICOLLIS

Dr. Royal Whitman presented a patient fifteen years of age, illustrating the operative treatment of congenital torticollis. The points to which he called attention were the complete division of the contracted muscles and fascia to permit overcorrection of the deformity, and the necessity for after-care by manual stretching and exercises. By drawing the skin upward at the time of operation the scar was eventually below the clavicle, a point of importance in the treatment of girls.

Dr. Frank S. Mathews said that up to about three years ago in doing torticollis, he used to put the head and upper part of the chest in plaster. Since then, in eight or ten cases, he had simply divided the skin and all contracting tissue, applying a simple dressing and letting the child put the head in any position it wanted, which, of course, would be the original one, until the wound was healed. After that he began the correction. If overcorrection is tried at once, it tends to pull the wound apart. It seemed to him there was an advantage in letting the skin wound heal firmly and then beginning the correction of deformity, in say eight or ten days.

Dr. Whitman, in reply to Dr. Mathews, said that he supplemented complete division of the contracted tissues by a vigorous stretching, and if the patient was a child, fixed the head for several weeks in an overcorrected attitude by a plaster support. The aim was to overcome what might be called the deformity habit both in the patient and in the structure of the neck. He thought wide separation of the divided tissues of great advantage and had seen no ill effects from it.

SUBACUTE DUODENAL PERFORATION

DR. WALTON MARTIN presented a man twenty-six years old, who was admitted to the medical service of St. Luke's Hospital on October 31, 1916. The day before admission, at nine o'clock in the morning, while drinking a cup of coffee he was seized with agonizing pain in the abdomen. He vomited several times, the vomitus did not contain blood. A doctor was sent for and gave him morphine. In the evening he was again in great pain and developed a slight cough; he saw the same physician, who sent him to the hospital with the diagnosis of pneumonia.

He had been in good health before this attack excepting for slight indigestion. Two and a half years ago he had a similar attack of severe abdominal pain and vomiting. This attack had lasted three days. He thought the pain at that time had been in the right lower quadrant of the abdomen.

On admission his temperature was 102.8°, his pulse 118, and his respiration 28. The leucocyte count showed 18,000 white cells with 70 per cent. polymorphonuclears. The patient looked sick. There was slight dulness over the right lower lobe posteriorly. The abdomen was not distended. There was no rigidity. There was acute tenderness on palpation over the upper right side of the abdomen.

The X-ray examination showed an area of lessened density above the shadow of the liver and below the outline shadow of the diaphragm. The X-ray operator, Dr. LeWald, ventured the suggestion that there was free gas in the peritoneal cavity.

Dr. Martin had advised an immediate operation. The medical attendant refused, however, to give his consent. The patient did not improve, the fever continued, the pain persisted and gradually a large mass became palpable in the right lumbar region, apparently in front of the kidney. He was finally transferred to the surgical division and eleven days after the onset an abscess was opened and drained through the upper margin of the right rectus. The pus which was evacuated had a foul odor. An X-ray examination taken the next day showed the cæcum in a normal position. It also showed a deformity of the duodenal cap.

The edge of the wound became irritated by the discharge from the abscess, suggesting a perforation of the upper intestinal tract. The patient made a good recovery, and since his illness has been free from the indigestion which he has had for many years.

Dr. Martin said he had shown the case on account of the difficulty in diagnosis and on account of the unusual interest of the X-ray findings. He believed the case to have been one of subacute perforation.

Moynihan reported a series of similar cases and discussed the condition in full in the February number of the ANNALS OF SURGERY in 1907. He writes, "Whereas in usual 'acute' perforations of the duodenum the rupture is of fair size and at once allows the contents of the gut to spread themselves freely over the general peritoneal cavity and to cause there a universal infection, in subacute perforation there is, by one agency or another, a definite localization of the fluids escaping from the duodenum and, in many instances, a narrow circumscription of the peritoneal response to their invasion."

This localization he points out may be due to a very small perforation, an empty stomach at the time of perforation, or the plugging of the opening by omentum.

In the November number of the *American Journal of Röntgenology*, there is an abstract from the *Munch. med. Wochensch.* of August 29, 1916, p. 1278. Robert Lenk, who was on the Isonzo Section of the Eastern front, calls attention to the appearance of gas bubbles between the right diaphragm and the liver in the shape of a light, narrow semilunar strip above the hepatic border in certain cases of bullet perforation of the gastro-intestinal tract. He suggests that in times of peace this sign will be found of value in differentiating between perforated gastric ulcer and acute appendicitis or cholecystitis.

The X-ray plates in this case show distinctly this narrow semilunar strip of lessened density above the right lobe of the liver (see Fig. 7). Doctor Martin said he believed this observation of Dr. LeWald to be of real value in differential diagnosis.

THE LIMITATIONS OF RADIUM IN SURGERY

DR. EDWARD M. FOOTE read a paper with the above title, at the close of which he presented a man, stating that some eleven years ago he had a sore on the right side of his lower lip. About ten years ago it was removed by excision of a small piece of the lip, the wound being sutured. Some time after that he had a local recurrence. This was variously treated by caustics and X-ray, and in 1913 he came under Dr. Abbe's care, who treated him by the application of radium in periods of two hours each, causing a temporary disappearance of the tumor. Then Dr. Abbe went to Europe in 1913, and the patient for the first time came under Dr. Foote's observation. At that time he had a scar from his previous operation and caustics, with enlarged glands beneath the jaw on both sides.

An incision was made through the lip extending under the jaw, both to the left and right, and the glands and surrounding tissues, including

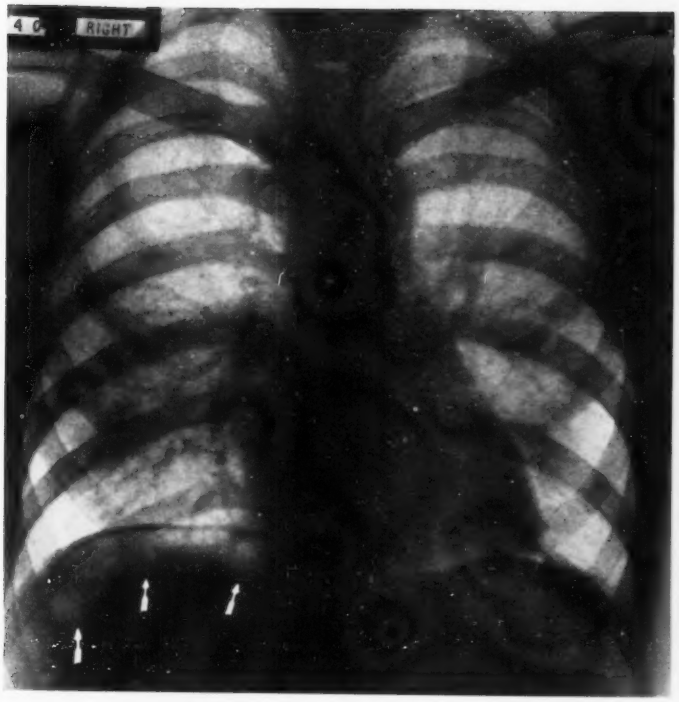


FIG. 7.—Case of subacute perforation of the duodenum, showing narrow semilunar strip of lessened density above the right lobe of the liver (see arrows).

skin, were removed and the wound was sutured. Not quite a year afterwards he again had a small recurrence, this time in the lip only. It was cut out without the neck being disturbed. The lip was restored, a certain amount of flap being obtained from the cheek. This was in January, 1914.

It is now three years since that time and there has been no further recurrence.

Stated Meeting, held January 24, 1917

The President, Dr. Charles N. Dowd, in the chair

BILATERAL DIRECT INGUINAL HERNIÆ WITH BILATERAL ADENOMYOMA OF ROUND LIGAMENTS

Dr. Frederick T. Van Beuren presented a woman, thirty-four years of age, who was admitted to Roosevelt Hospital, November 20, 1916, on account of pain in the groins and pelvis, and an irreducible mass in each inguinal region.

Operation (November 27, 1916).—Right side incised down to cystic tumor which lay outside of the external oblique. It was freed from surrounding structures, ring identified, and external oblique aponeurosis split upward, exposing internal oblique and hernial sac which was about 3 inches long and ½ inch wide, thickened and very adherent to the surrounding tissues. Sac of hernia dissected free, sac opened, found not to communicate with cystic tumor, neck explored into the peritoneal cavity, neck transfixed, ligated, amputated and stump dropped back. Internal oblique brought down to Poupart's ligament with four interrupted chromic sutures; the upper two sutures passing through the round ligament, anchoring it in place. Aponeurosis of the external oblique united by plain continuous catgut, the skin by silkworm gut and silk. Dry dressing and binder applied. The left side was treated in a similar manner. The tumors were removed with distal end of hernial sac and round ligament.

Report of Pathologist.—The specimen consists of two irregular globular masses of dark blue colored tissue, measuring 3½ to 4½ cm., covered by fibrous adhesions, presenting numerous crypts and indentations. Several small, thin-walled cystic bodies are seen on the surface. A small cylindrical tab, the size of a vermiform appendix, is attached to one side; the interior shows a dense, light colored stroma, in which appear numerous large and small cysts, some containing a hemorrhagic, and others a mucoid fluid. In the gross the specimen presents much the appearance of tissue from a cystic ovary. Three sections for microscopic examination.

Microscopic Examination.—The mass of the sections seen are made up of a stroma of smooth muscle and fibrous tissue arranged in an atypical manner.

The former are often seen in variously arranged bundles separated by well-defined fibrous septa. In some places the smooth muscle arrangement resembles much the make-up seen in ovarian stroma. The epithelial elements that are present are arranged forming cyst walls. Some are low cuboidal in type and disposed in a singular layer about irregular cavities containing hemorrhagic material and a variable degree of débris. Others have an adenomatous arrangement and are high columnar, resembling the cells which normally are found in the glands of the uterine mucosa. There is a frequent focal collection of round-cells and in one situation are most peculiarly arranged groups of spindle- and round-cells with wide epithelial spaces which have probably been filled with cholesterin crystals.

Microscopic Diagnosis.—Adenomyoma of round ligaments.

December 15, 1916: Discharge note: Scar holding firmly. No bulging or impulse on coughing or standing. No pain. Feels fine. Discharged cured. Highest post-operative temperature 101°.

RUPTURE OF LIVER

Dr. H. B. Delatour presented a boy, aged ten, who was admitted to St. John's Hospital, Brooklyn, February 24, 1916. Two days before admission while coasting he was thrown from his sled, striking the stump of a tree. Shortly after he was seen by his family physician who made a diagnosis of internal hemorrhage. He was in deep shock with very rapid and feeble pulse. He slowly improved. He continued to have severe abdominal pain. On admission temperature was 100.6° F., pulse 102, and respirations 24. The patient complained of abdominal pain with no point of tenderness. Examination showed moderate distention and dulness in both flanks without marked tenderness. The general condition was fair. The following day the condition remained the same, temperature at 8 P.M. was 100° F., pulse 82, and respiration 26. During the day patient had vomited some medication and curdled milk.

Operation.—Upper abdominal median incision. On opening, two quarts of blood escaped. There was no evidence of recent bleeding, the cavity was sponged dry and on the under surface of the right lobe of the liver was found a tear four inches long. As there was no bleeding this was not sutured. Abdomen closed without drainage. Recovery was uneventful.

Dr. Delatour presented also a boy, aged six years, who was admitted to the Norwegian Hospital October 22, 1913, having been run over by a delivery wagon about fifteen minutes before. Examination showed the wheel had passed across the lower right chest and upper abdomen. The patient was in severe shock, lips pale, pulse rapid and weak and there was evident active intra-abdominal bleeding. The abdominal

wall was rigid, there was tenderness in the right hypochondriac region and marked dulness in both flanks. There was a marked tenderness over the right kidney.

Operation (on day of admission).—Median upper abdominal incision. On opening the abdomen there was an escape of fluid blood. In the under surface of the right lobe of the liver was a tear about two inches long. Pressure with a sponge soon checked this and the edges were brought together by a catgut suture. During the examination a large hæmatoma was found post-peritoneal about the right kidney. Abdomen closed without drainage. The temperature ran between 99° and 101° until the fourth day, when there was a sudden rise to 104°. The temperature remained between 102° and 105° for forty-eight hours when it suddenly dropped to normal. There was a slight rise during the next two days, but the third day the temperature reached 105°. The pulse was 160, respirations averaged from 48 to 56. Dulness persisted over the right chest. Resection of the ninth rib was done, the pleural cavity opened and considerable blood-stained fluid evacuated. Notwithstanding this, the temperature continued to fluctuate between 102° and 104°. A few days later a mass could be made out in the neighborhood of the right kidney. An incision in the right lumbar region evacuated a quantity of pus; the kidney was not involved. Drainage was established. The temperature gradually fell following this operation, reaching the normal about two weeks later. The patient was discharged from the hospital March 7, 1914.

In both these cases the force of the blow was delivered from in front with the tear on the under surface of the liver. This is evidently due to the bending of the organ and the giving way of the capsule when it can no longer stretch. It has been his experience to find the tears generally in this position. It is worthy of note the ease with which hemorrhage may be checked by pressure even in quite extensive and deep tears of the liver.

CANCER OF THE RECTUM

Dr. Delatour presented three cases which were operated within ten days of each other, and each shows a different way in which the case was treated before coming to operation.

The first was a case of carcinoma low down in the rectum, which had been going about for over a year complaining of intestinal symptoms and hemorrhoids. He had been given a superficial examination for hemorrhoids twice and nothing was discovered. Later a rectal examination had been made and a diagnosis of possible syphilitic ulceration was made and he was given salvarsan treatment, without benefit.

He came under the care of Dr. Delatour in the latter part of September, and on September 30 a complete excision of the rectum and lower sigmoid was done by the combined method, with the production of an abdominal anus. During the perineal stage, while making strong traction during the separation from the prostate, the urethra was torn free of the gland. To remedy this a method was used which had been found useful in two similar cases, the result of accidental injury. A catheter was passed through the urethra into the perineal wound and then passed into the bladder. It was then sewn by two chromic sutures to the anterior edge of the prostate. Traction was then made on the catheter until it brought the divided ends of the urethra together. A safety pin passed through the catheter at the meatus kept up this elastic pressure. The catheter was removed at the end of a week and sounds passed. The union was perfect and they never had any trouble from urinary leakage.

The abdominal wound healed very slowly, owing to dry gangrene of the rectus muscle. No adequate reason for this could be found. There was no apparent sepsis, and the blood supply was not interfered with. The man was very weak and much reduced and traction on the blood supply during operation may have been responsible. As a result of this the wound healed by granulation, leaving a hernia to be repaired later. He is wearing the colostomy apparatus designed some years ago by the reporter and he is perfectly confident of not soiling himself while going about.

Dr. Delatour said that formerly he did a two-stage operation, but now in most cases he was better satisfied with a completion of the operation in one stage. After making the abdominal incision and incising the peritoneum at the level of the reflection of the bladder and exposing the ureters, the dissection is carried down in front to the prostate and posteriorly to the coccyx. The bowel is then severed at the level desired, both ends of the bowel are tightly closed, the upper end placed in the desired position for the anus and the lower section tucked into the pelvis. When there is more bowel than will comfortably go into the pelvis a section is removed. The peritoneum at the brim of the pelvis must now be carefully closed over this mass. After closing the abdominal wall one may or may not proceed with the removal of the distal segment. The second step consists of an incision about the anus carried back to the coccyx, no bone is removed, and then the dissection carried up until the bowel is freed and removed. As this stage takes only from eight to fifteen minutes and is not attended by hemorrhage, most patients can well stand it.

The second was a man fifty-six years old who for a year and a half had been suffering with abdominal pain and had had one attack of partial obstruction which was relieved after lasting for twenty-four hours. On April 27, 1916, he had another attack of obstruction which was complete and lasted for four days before he was operated.

At that time there was a great deal of distention and the operator did not think it wise to do a radical operation. He discovered a mass in the upper end of the rectum and simply made a colostomy.

The patient made a good recovery, but after a few days the fecal contents began to pass beyond the colostomy and out through the rectum and he began to suffer a great deal of disturbance. The colostomy opening narrowed down and did not give the desired relief. When he came to the reporter he had lost a good deal of weight and was suffering from the inconveniences of an anus which would discharge only a portion of the fecal contents, so that occasionally he would have a movement by the rectum. He was operated upon in the manner described on October 9 last. He has the same apparatus and he is going about his business now perfectly happy. He has developed regular periods for moving the bowel and at other times has very little drainage. The perineal wounds give no trouble.

This apparatus looks rather large and cumbersome, but still the patient does not complain and it hardly shows at all in the clothing.

A third case was in a man forty-eight years of age, who, for about a year, had been having rectal symptoms when a carcinoma was discovered in the lower third of the rectum. A similar operation was done.

These men wash out the bowel once or twice a week, maybe once a week taking a cathartic, and go about with perfect comfort and feeling of security.

Dr. Franz Torek said that he had recently done a one-stage operation for carcinoma of the rectum. In this case he did a complete amputation of the lower end of the rectum by the one-stage operation, that is, first median incision, loosening everything, as has been described, down to the pelvic floor—to the levator ani—and then operating from below by resection of the coccyx and bringing down the tumor end and loosened portion of the bowel to the anus.

He said that he was very well pleased with it. In the first place, there is only one opening, the natural opening, and in the second place, one thing that he feared—that there would be a constant leakage of the fæces from the anus—did not occur.

At the present time this woman has a movement only every second

day, although there is no doubt that the sphincter cannot have its normal impulse of contraction because with the removal of the lower end of the rectum the terminal fibres which would stimulate the sphincter to contract must have been divided.

Dr. Delatour rejoined that in three cases in which he made a perineal implantation there was complete lack of control and the patients were certainly very much more uncomfortable than with an abdominal anus. It is much easier to take care of the abdominal anus than it is a perineal anus if there is lack of control.

He had had three cases operated by the combined method in which he did a two-stage operation. Two of these cases did not react well during the next day or two and he did not feel like giving them an anæsthetic again and the intestine that was left in the pelvis set up sepsis which gave considerable anxiety.

In one case he did the second stage of the operation on the fifth day, under hyoscine and morphine, and the patient made a good recovery, but he was very much worried during the whole time he was waiting to get her in condition to do something for fear of general sepsis developing.

As he does the operation now, so much is done from above that the second stage of the operation is very short; the incision is carried back to the coccyx and there is no bone removed. Bleeding is practically all controlled from above before you make your incision below.

He preferred the median position of the anus, going through the fibres of the rectus muscle to the lateral, because his apparatus can be more easily fitted in that position.

He had a record of one case eight years, one seven years, another four and another two by this method without any recurrence. The man who is six years is a captain on a steamer and is going to sea regularly. He believed that where one removes a large section of the bowel and thoroughly cleans out all the fatty material in the hollow of the sacrum where the glands are, one has an excellent chance for a permanent cure.

He had had eight successive cases now without death.

Dr. Charles N. Dowd, in discussing these cases of excision of the rectum for carcinoma, called attention to the vigor and strength of the patients. The one-stage combined operation is a severe procedure, but when one is to deal with strong men of middle age such as these patients are, one may do a very much more severe operation in one stage than would be practicable for less vigorous patients. The two-stage operation in which the upper part of the distal intestinal segment

is left as a pouch, as advocated by Mayo, gives a method of securing a very thorough operation with less danger than the one-stage operation necessitates.

TREATMENT OF BURN BY PARAFFIN MIXTURE, AND BY SKIN GRAFTS WITH DRESSING OF ADHESIVE PLASTER (VOSBURGH METHOD)

DR. CHARLES N. DOWD presented patients illustrating the two methods which had been considered at the November 22 meeting of the Society (ANNALS OF SURGERY, lxv, 370). Soon after that meeting he had used a paraffin mixture for two cases of extensive burn then in the wards of the Roosevelt Hospital. The mixture used was prepared by the house surgeon, Dr. Raymond H. Schulz, and was composed of paraffin, two parts, vaseline, two parts, and stearic acid, one part. It melted at 112° F., and could then be easily applied to the burned surface by cotton pledgets held in dressing forceps, the resulting film making a protective dressing which was further guarded by gauze. The dressings were changed every second day.

One of the cases improved very satisfactorily. In the other, the granulations quickly became exuberant, and skin grafting was resorted to.

The difference in the two cases seemed due to the depth of the burns. Islands appeared in the surface of the first case, which indicated that the skin destruction had not been complete, although it had appeared so. Epithelium ran out from these islands very rapidly under the paraffin film. (The appearance is well shown in Fig. 8, and the rapid rate of growth is shown in the accompanying diagram, Fig. 9.)

The patient had been under various forms of treatment for about ten weeks before the paraffin treatment had begun, and had recovered from the constitutional depression, which had been very great at first. The result of the paraffin treatment was remarkably satisfactory.

The second case, a child of five years, had been treated for twenty-nine days for a severe burn, involving the posterior portions of thigh and leg, with warm air, wet dressing, and rubber tissue with splint. On December 4, paraffin dressing was applied. On December 14, the areas were strapped transversely with zinc oxide adhesive plaster because the granulations had become so exuberant under the paraffin treatment; these straps were applied very firmly for eight days when the granulation had become smooth and almost flat. Thiersch skin grafts were then removed from the anterior and outer surface of the right thigh and were applied to this granulating surface after it had been washed with saline solution. Straps of zinc oxide adhesive

plaster were then applied transversely across the grafted area, and a roller of gauze was placed outside of them. These straps were left in position for six days, after which they were carefully removed.

At that time, about seven-eighths of the area was covered by grafts or by visible epithelial pellicle, and about one-half of the remainder

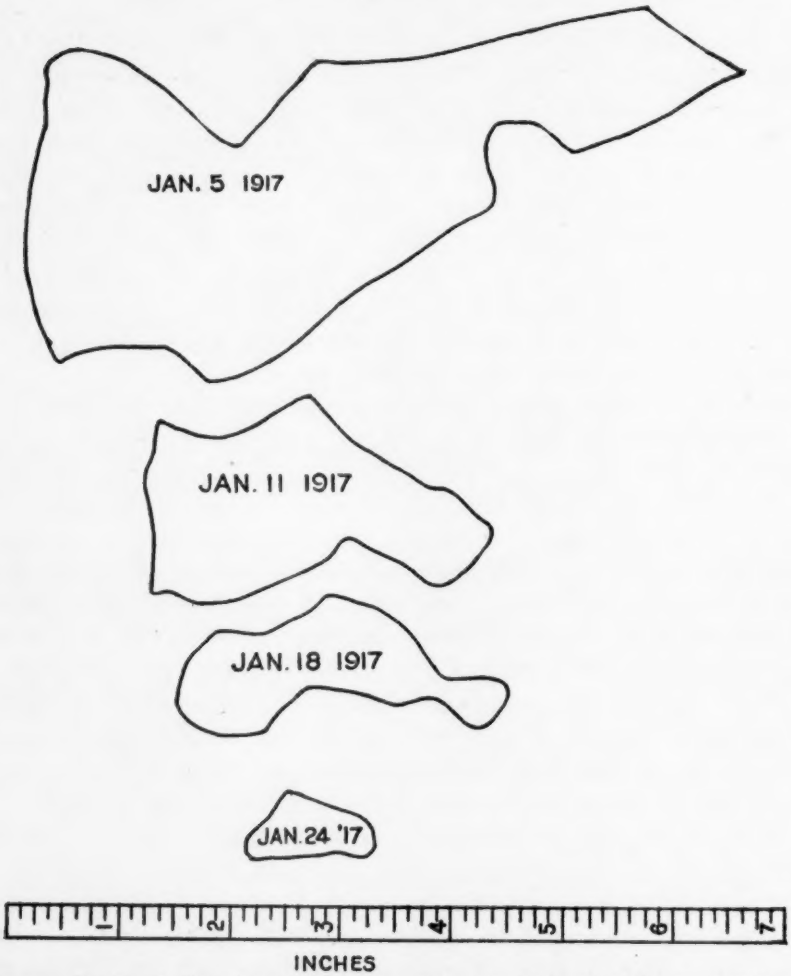
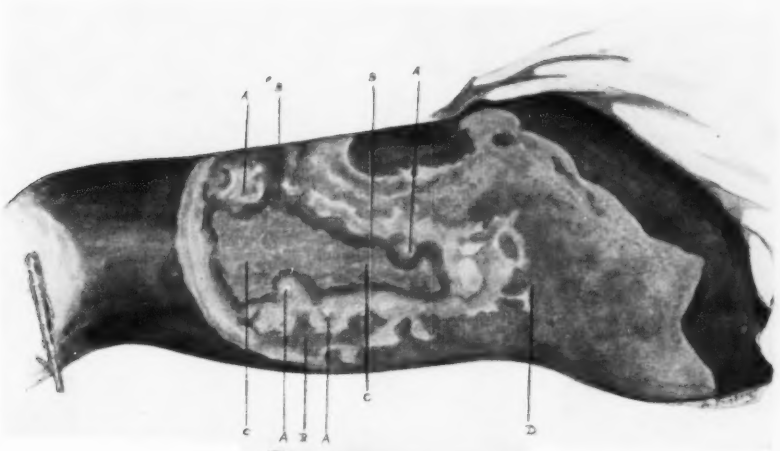


FIG. 9.—Treatment of burn by paraffin mixture. Progressive diminution in size of granulating area shown by the cutting of rubber tissue models at intervals of six and seven days.

looked as though a very slight epithelial pellicle might be present. Another similar dressing was then applied and left in position for five days. On its removal the grafts seemed much firmer, and the epithelial pellicle which existed where the superficial grafts had come away was more definite.

FIG. 8.



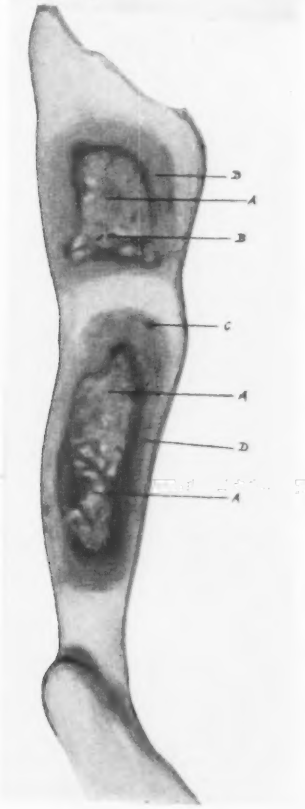


FIG. 10.

FIG. 8.—Appearance of burned thigh, four weeks after paraffin treatment was begun. *A*, islands from which epithelium extended; *B*, newly-formed epithelial pellicle; *C*, granulating surface; *D*, newly-formed skin in the more superficial parts of the burn.

FIG. 10.—Burn treated by skin grafts held in position by adhesive plaster (Vosburgh method). Sketch made fifteen days after the application of the grafts. *AAA*, grafts which had united over the entire surface excepting at the small spots *B*; *B*, small spots where the plaster had rubbed the grafts and prevented union; *C*, small granulating area which had not been grafted; *DD*, margin of burn where the skin had thickened before the grafts were applied.

A paraffin mixture was then applied over the grafts, and gauze outside of this. (Fig. 10 indicates the appearance of the leg four days later. The grafts had all taken excepting a very small area where the motion of the leg had caused rubbing from the adhesive plaster.) At a later time, a little pus collected under some of the grafts, and consequent delay in the final healing was thus caused. This accident could probably have been avoided by removing the granulations before applying the grafts, according to the method in ordinary use.

The paraffin mixture was applied to the area on the right thigh from which the grafts were cut, and the healing of this area was very satisfactory, much better than in any case which the writer had seen when treated by other methods.

Dr. Ransom S. Hooker said that on the First Surgical Division of Bellevue Hospital there had been treated several cases of burns with ambrine. The first case was a man with first degree burns of the face and both hands. On the third day after admission the ambrine treatment was started; before which he had been treated with hot air. Ambrine was applied to his face and one hand, using the other hand for comparison, although the hand treated by ambrine was much more extensively burned than the other.

The paste could not be applied as advocated, 140° to 150° F., for the man complained so much a heat of only about 130° or 135° could be used. The hand healed up very well in eleven days, about the same time as the other hand which was treated with dry air and alkaline baths. He doubted if the face healed any faster than is usual with routine treatment.

The next case was a woman, who was admitted on September 13 with very extensive burns of the back, buttocks, both thighs posteriorly and the right arm and hand. She had been treated by hot air and by alkaline baths. On the sixth of December she had healthy granulating areas over these parts. Ambrine was applied to the right arm and hand and to the left leg. The left leg was chosen as being possibly a little worse than the right, although there was very little difference, but the right was kept as a control. On December 19 the ambrine leg had improved very much over the leg treated by hot air, so Dr. Vosburgh strapped the right leg; on January 5 the right leg was healed, whereas the ambrine leg was only two-thirds healed, so it was decided to abandon the ambrine and strap the arm and both legs, which were all healed by January 15.

Another case was a very severe burn in a girl four years old. The back, abdomen and legs were burned, first and second degree. She

was in considerable shock, yet ambrine put on at a temperature of 130° caused a great deal of pain. Only one application was made, as she died in twelve hours.

The next case was a girl of ten with first degree burns of the buttock and thighs. They had a great deal of difficulty in putting the ambrine on, as she complained so much of the pain; they had to drip it on with the brush, instead of applying it lightly with a brush as with the other cases. After two dressings it was given up because she complained so bitterly of the pain.

The last case was one of the attending surgeons who scalded his arm in the operating room. Ambrine was applied to the arm at a temperature of 150° F. which he decided was too high, but it relieved him from pain immediately, and the burn healed without forming blebs.

He felt that enough cases had not yet been treated with ambrine to really pass judgment, but was inclined to believe that the advantage of ambrine had been rather exaggerated.

Dr. Seth M. Milliken said that the open-air treatment of burns brought out the point mentioned as to islands of epithelium in the raw area very plainly. Where there is no dressing applied and the granulations have been for some time in a fairly flat condition, the islands in many cases were very rapidly developed, although the burn extended apparently clear down to the fat and apparently at the time of separation the entire skin had sloughed off.

In the Bellevue Dispensary he had a burn discharged from the ward under a boric acid dressing which on admission involved the entire right half of the chest. At the time he was discharged from ward it involved one-third of the side of the chest—that is, a little more than the entire axillary region. Under boric acid dressing it was tender and entirely raw. That was strapped with adhesive, and he came back saying he had been free from pain under the strapping. On removing it there were many areas of epithelium evident and the edges had grown in in two days at least half a centimetre. He healed up in twenty-seven days, with dispensary treatment, and he had been in the ward some five weeks before discharge. As soon as the epithelium had covered the area, instead of using an oily dressing, the wound was very thickly powdered with stearate of zinc, which protected the surface so that there was no pain in moving the dressing.

Dr. Wiener said that in the last eight years he had not put any dressing on any skin graft. It is perfectly astonishing, not only how often the grafts take, but how quickly. In forty-eight hours the grafts

have taken if one puts no dressing on whatever. Not only do they take, but they stay taken, in children and adults and in all parts of the body.

The patient is put in the proper position and the grafts exposed to the air. One can see the next morning already that the grafts have taken. A few of the men who have tried it have made the mistake of putting on a vaseline dressing after a week. Even that should not be done, not even vaseline should be put on these grafts for ten or twelve days. He had not had a single real failure in eight years—no matter how big the grafts were or where they were, no dressing was applied. The granulations must be carefully prepared either by scraping with a sharp spoon or by cutting them down with knife or scissors. It depends on the individual case as to what preparation the granulations need, but once the grafts are on nothing is put on the graft, not even vaseline for twelve days. If that is done, about a hundred per cent. will take.

SPLENECTOMY FOR THE SPLENIC FORM OF HODGKIN'S DISEASE

Dr. Charles N. Dowd remarked that in writing of the splenomegalic form of Hodgkin's disease Osler states that "it is not improbable that the disease may originate in the lymphoid tissue of the spleen and several cases have been reported of late years by Ziegler, Symmers, Warrington and others. It must be very difficult to distinguish such cases clinically from the early stages of Banti's disease." Such cases are surely uncommon. The palpable lymphatics usually give the most noticeable lesion in Hodgkin's disease.

He presented a boy of eight years who he believed to be one of the exceptional cases. An enlarged spleen was first noticed last summer while recovering from diphtheria in the Willard Parker Hospital. He came under Dr. R. G. Freeman's care at the Roosevelt Hospital in November, showing an enlarged abdomen with ascites, a very large spleen, a large liver and extreme anæmia. There were no other noticeable lesions. The spleen extended 5½ inches below the costal margin in the left nipple line and 3 inches below it in the axillary line. It was hard and the notch was easily felt. The liver edge was felt 2 inches below the right costal margin.

Chest examination, urine examination, Wassermann test, von Pirquet test and bacterial culture from throat were all negative.

The results of three blood examinations were as follows:

October 31, 1916: Red blood-cells, 1,380,000; hæmoglobin, 40 per cent.; white blood-cells, 12,200; red cells many; polymorphonuclears,

64 per cent.; macrocytes and normoblasts to 120 whites counted; lymphocytes, 23 per cent.; endo., 6 per cent.; transitionals, 2 per cent.; eosinophiles, 4 per cent.

November 20, 1916: Hæmoglobin, 33 per cent. Sahli; red blood-cells, 3,072,000; Ck., 53; white blood-cells, 8,800; polymorphonuclears, 71 per cent.; lymphocytes, 21 per cent.; leucocytes and transitionals, 1 per cent.; transitionals, 5 per cent., no abnormal cells; eosinophiles, 2 per cent.; normoblasts, 3.

November 27, 1916: Hæmoglobin, 34 per cent.; red blood-cells, 3,176,000; C. I., .54; white blood-cells, 10,200; polymorphonuclears, 77 per cent.; lymphocytes, 21 per cent.; L. M., 3 per cent.; transitionals, 8 per cent.; eosinophiles, 1 per cent.; normoblasts, 1; myeloblasts, 0.

His temperature ran frequently to 103° or 104°. The periods of elevation and remission of temperature were irregular.

Open air and other methods of treatment were used for about five weeks without improvement. Splenectomy was then advised as a desperate chance and he was transferred to the First Surgical Division of the Hospital for that purpose. The operation was done December 9, 1916. The spleen was adherent to the surrounding structures, but the adhesions were separated without particular difficulty; it was removed after ligation of its pedicle. There were 3 or 4 lymph-nodes at its hilum fairly firm and about ½ inch in diameter. No other enlarged lymph-nodes were found.

The pathological report from the spleen and lymph-nodes was as follows:

Gross.—Tumor is 20 cm. by 13 cm. by 7 cm. It is light purple and is covered with an unorganized layer of fibrin. The organ contains numerous nodules of alternate loose and dense structure which look whitish and a little caseous. Lymph-nodes enlarged but show no other gross abnormality.

Microscopic.—Sections show areas of necrosis with infiltration of many polynuclear cells. Normal architecture of spleen has disappeared and has been replaced by groups of lymphoid cells with intervening, moderately loose reticular tissue containing few cells. The lymph-cells show no unusual features, but in addition there are many "Dorothy Reed" cells throughout. Eosinophiles are present in places. No definite Malpighian corpuscles are seen in entire section. Lymph-nodes show no abnormality except "Reed" cells which are seen in moderate numbers.

Microscopic Diagnosis.—Hodgkin's disease of spleen and mesenteric lymph-nodes.

The boy has improved steadily though slowly since his operation and now is out of bed and sitting in a chair in the ward a part of each day. His blood did not show much improvement until January 22, when transfusion of 300 c.c. of blood was made. His red corpuscles are now 3,200,000 and his hæmoglobin 65 per cent. He is gaining in strength, but recently has shown slight ascites again. Urine examination has remained negative.

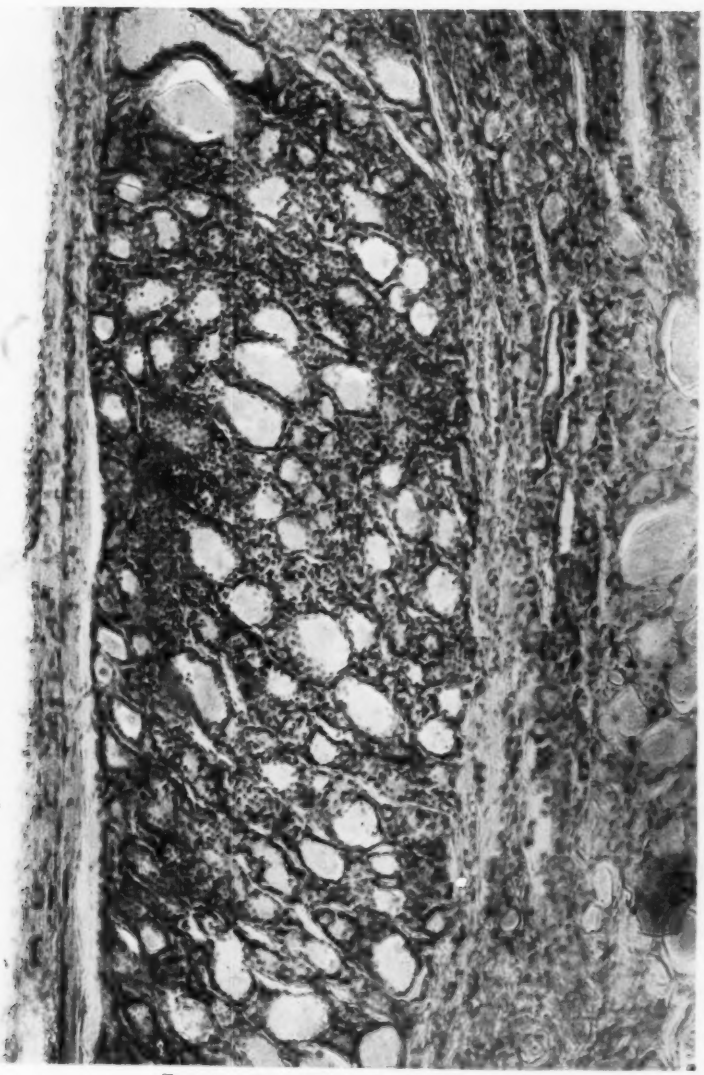


FIG. 11.—Carcinoma of the thyroid.

CARCINOMA OF THYROID

Dr. Clarence A. McWilliams presented a girl, eighteen years of age, who was admitted to the Presbyterian Hospital on August 27, 1914. Three years previously she had noticed that her neck was growing larger. It has grown steadily larger since then. No evidences of Graves's disease, *i.e.*, she is not nervous, no tremors, no sweating, eyes never prominent, skin not dry, no diarrhœa, no palpation, no dyspnœa, has lost no weight, pulse normal. Examination showed a single goitre, 5 by 10 by 5 cm., occupying the midline of the neck and extending well around to the left side. No thrills nor murmurs were heard over it. On August 28, 1914, the entire right lobe was removed except a small stump protecting the right inferior thyroid vessels. The tumor was very firm, very vascular and adherent, so that removal was difficult. The tumor also involved the isthmus and this was removed together with about half the left lobe.

Sections from tumor mass, although in a very young person, were found by the pathologist to correspond to one of the types of carcinoma which is well recognized as a *carcinoma*, and although seldom seen, is unquestionably a malignant growth. Dr. MacCallum corroborated this diagnosis.

As a result of this pathological report, it was deemed best to do a second operation to remove the remains of the left lobe.

Second operation, Sept. 7, 1914—Old wound opened up. Recognition of the anatomy was difficult, but remains of left lobe were identified. The inferior thyroid artery was tied and the lobe removed *in toto*.

Pathological Report.—Specimen consists of a portion of what appears to be the left lobe of the thyroid, attached to which is a flat bit of tissue, 4 by 2½ by 1 cm. The lobe of the thyroid appears to have normal thyroid tissue and it cuts with fairly typical resistance. The tissue attached to the lobe of the thyroid, however, cuts with much firm resistance and appears to be an infiltrating whitish, possible tumor tissue, the remains of the former carcinoma.

Microscopic Examination.—Left lobe of goitre shows considerable dilatation of the majority of the acini with flattening of epithelium and distention of many of them with colloid material. Portion of tumor which was left behind at first operation shows a considerable amount of dense, fibrous, connective tissue and one section shows remains of thyroid tissue in which the epithelial cells have a glandular arrangement in some cases (Fig. 11). In others they are arranged in islands infiltrating the surrounding tissue, showing no evidence of encapsulation or limiting membrane.

Diagnosis.—Colloid goitre, carcinoma of thyroid. Primary union.

The patient was referred to Dr. Corscaden for X-ray treatment, which was begun September 15, 1914. The dosage was as follows: Spark gap, 22 cm. anode; skin distance, 25 cm.; filter, 3 mm. aluminum, 1 cm. of wood. The neck was divided into three areas and through these were given from September 15, 1914, to December 30, 1915, 1000 milliampère minutes, in three sessions, about four months apart. After each application the skin became erythematous. Permanent change in the skin has been a slight tanning. The patient was put on thyroid tablets for trial, but these had to be discontinued because of rapid heart action and general discomfort. Now, two and a half years after the operation, the patient is perfectly well. There are no symptoms of myxœdema. She feels perfectly well. There are no evidences of any recurrence of the tumor locally. There are no enlarged cervical glands nor distant metastases. Röntgenogram of the chest shows it to be clear, with no evidences of any growth in the lungs.

Dr. John Rogers remarked that carcinoma of the thyroid is one of the rarer forms of malignant disease. This is fortunate, because very seldom is the diagnosis made in time to place the case in the operable class. A good many of the carcinomata of the thyroid show hyperthyroid symptoms, and it is quite easy to mistake the condition for one of exophthalmic goitre.

The interesting point about this case is the absence of the thyroid and the absence of symptoms. The patient seems to be in perfectly good condition, and yet Dr. McWilliams is sure that he has left no thyroid gland. Dr. Rogers had seen a good many bad results from thyroid operations, but he did not remember ever having encountered a case of true cachexia strumipriva. The text-book's description of the severe and fatal post-operative myxœdema has not occurred in his experience, and yet he had observed at least a dozen cases of thyroid disease in which the operator believed that he had entirely removed the thyroid gland. Cases operated for symptoms of hyperthyroidism are somewhat different. If the operation is not successful, the symptoms of hyperthyroidism continue, with some modification perhaps from the original form, but without manifest myxœdema. There are one, or possibly two, explanations for this. It is not impossible in the first place that the thyroid secretes during any given moment an extraordinarily small amount of fluid, and if any portion of the gland remains the extraordinarily small amount of material which the thyroid produces may still be produced by the remaining portion of the gland.

A number of years ago he dissected about sixty cadavers, and ex-

amined with the microscope all tissues in the neighborhood of the thyroid. From each cadaver there were examined, on an average, eight pieces of tissue, and at least one or two out of these eight pieces in each body were fragments of thyroid which were indistinguishable in the gross from the parathyroid or lymphatic glands. These pieces were scattered from the base of the skull to the region of the heart, and there are a few reports of thyroid tissue in the heart muscle itself. Consequently, after the removal of the whole thyroid gland there are a considerable number of chances that some aberrant thyroid tissue remains. The old-fashioned "cachexia strumipriva" was produced by the removal of simple goitres and may have resulted so frequently in former times because of the characteristic thoroughness of a German operation. Why hyperthyroid symptoms should persist after the removal of all of a gland, as they sometimes seem to, and why myxœdema should be intensified after the same operation is very puzzling.

RIB GRAFT FOR SADDLE NOSE

DR. CLARENCE A. MCWILLIAMS presented a man twenty-four years of age, who was struck on the bridge of nose by the hoof of a horse fifteen years ago. The nose was depressed and broken, but the doctor made no attempt to elevate it. No trouble from it now except that he desires to have a straight nose. Examination shows that the tip of the nose stands up well and normally but between the tip and the frontal bone there is a marked curve with the convexity looking backward (Fig. 12). The bridge of the nose is also very wide, as though the nasal bones had been much depressed. The operation of transplanting grafts from a rib was performed April 20, 1915, under intrapharyngeal ether administered through tubes into the mouth. A curvilinear incision was made with convexity downward just beneath the ends of the eyebrows where the crossbar of spectacles would rest. Incision carried down to bone, where transverse and vertical incisions were made through the periosteum, which was elevated for half an inch down on nose. Narrow blade of knife was passed downward, dividing the subcutaneous tissues at their attachment to the periosteum. This separation carried down almost to the tip of the nose, and outward laterally on to cheeks, until finally the skin could be sufficiently elevated to make a straight line from forehead to tip of nose. Great care was exercised not to go into nasal cavity. The right ninth rib exposed in front by a vertical incision. Transverse incisions of periosteum on upper and lower borders of rib and the periosteum separated only on the posterior surface. Gigli saw inserted between the rib and the

posterior periosteum and the requisite length of rib lifted out, both ends being beveled in the sawing. This slipped nicely in place in the nose (Fig. 14), one beveled end fitting against the denuded raw frontal bone. It was seen that one graft did not lift the skin forward sufficiently, so a second piece of rib was obtained in exactly the same way and it was inserted in the nose with its raw posterior surface against the periosteum of the first graft. Fine silk interrupted sutures in skin. The oozing into the wound, resulting from the separation, was very free, so that the grafts were imbedded in a blood clot. This could not be prevented. The wound healed by primary union. The final result is good (Fig. 13). His appearance has been much improved.

BASAL-CELL EPITHELIOMA OF THE UPPER LIP

DR. N. W. GREEN presented a man who was admitted as a private patient to St. Luke's Hospital, November 5, 1913. He was at that time forty-two years of age.

Seven years before admission he first noticed a small sore on his upper lip. This was cauterized by his family doctor and healed up upon three separate occasions, only to break out again.

On examination the upper lip upon the right side of the median line appeared to contain a buried nodule 5 mm. in diameter with its centre cleft and with the skin and mucous membrane of the lip drawn inward to this cleft forming a groove. There was no elevation of the growth. The edges of this groove were smooth and there was no ulceration (Fig. 15).

At operation this scar or groove felt hard and indurated for an area of 1 cm. in diameter. The bone was not involved and there was no glandular involvement in the near vicinity.

Operative Procedure.—By suitable incisions which removed the growth about 2½ cm. of the lip was removed, repairing the defect by a plastic around each side of the nose, and loosening up the remnants of the lip on each side and drawing them forward. Great care was taken to avoid the growth and to incise wide of it. The patient left the hospital in eighteen days with the lip healed.

The pathological report was basal-cell epithelioma of the upper lip.

Subsequent History.—The patient was strongly advised on leaving the hospital to have the glands at the angle of the jaw removed at the earliest date possible, but having been encouraged by erring counsel he refused to submit to this till a year later, when he was again admitted as a private patient to the hospital, and was again operated on,

FIG. 12.—Saddle nose before operation.

FIG. 13.—Result of implantation of a rib graft to correct the saddle deformity of the nose shown in Fig. 12.

FIG. 14.—Skiagraph showing rib graft *in situ*, taken immediately after implantation in bridge of nose.

FIG. 15.—This shows the appearance of the lip before operation. Note the cleft or groove caused by the recession of the tissue due to growth. This is in striking contrast to the warty appearance of a growth of the lower lip.

on November 27, 1914, for the left side which showed a palpable mass at the angle of the jaw, and December 11, 1914, for the right side.

The pathological findings at the time of operation for removal of the glands of the left side were as follows: On the left side in the middle of the horizontal ramus of the jaw was a hard mass about 2 cm. in diameter not encapsulated nor attached to the bone or surrounding muscle. There were several smaller nodes along the carotid sheath. The scar in the upper lip was intact and normal.

Operative Procedure (on the left side).—A vertical incision was made along the anterior of the sternomastoid muscle, and a more horizontal incision was made to meet it passing to the midline of the neck at the level of the hyoid bone. This was then carried upward in the midline. The lymphatic structures and the growth (metastatic) were dissected out *en masse*. The skin was then closed throughout its greatest extent save for a couple of rubber tissue drains.

Operative Procedure (on the right side).—Fourteen days later a similar procedure was pursued on the right side. Some of the periosteum from the jaw was removed at this time, so near was the metastasis to the bone.

Eleven days after this operation the patient was discharged with all wounds healed.

The pathological report of the material from the operation of November 27 shows the following: A mass of gland bearing tissue from the left side of the neck showed diffuse invasion of the tissue by a neoplasm of the same type as was found in the lip. A small lymph-gland, separate from the main specimen, showed inflammatory reaction, but no invasion.

The pathological report of the material from the operation of December 11, 1914, shows the following: A mass of gland bearing tissue from the right side of the neck showed no diffuse invasion, but a small lymphoid nodule adjacent to the submaxillary gland showed metastatic growth.

This case has been presented for the following reasons: First, epitheliomata of the upper lip are infrequent, while epitheliomata of the lower lip are of common occurrence. Second, the growth was frankly of the basal-cell type yet contrary to the general belief it formed metastases, similar to the original growth. Third, it indicates the direct extension from this region backward of the lymphatics to the interior of the skull, as is shown by the probable nerve root involvement, although the regions of the wounds remain clear.

The fourth point, of less interest pathologically but of some interest

in the cosmetic result, is the placing of the incisions in the neck. Rather than the usual curved incision joined by the one down the anterior border of the sternomastoid, the incisions here were of an angular outline carrying the transverse part of the incision well down on the neck. It greatly helps to make a better scar and prevents the "lantern jaw" appearance after these dissections.

The case has been shown largely for its pathological interest.

SIGMOID DIVERTICULITIS

DR. WINFIELD S. SCHLEY showed a patient who was admitted May 26 last to St. Luke's Hospital. Three days before admission she was taken with generalized pain over the lower abdomen. A saline was taken, but without benefit. On the morning of admission (the third day of attack), she was given a large dose of oil. This greatly aggravated the symptoms and produced the first nausea and vomiting. She had no chills and was not conscious of fever until the day of admission. There was present frequency of urination. Patient had been well in the past except for an attack of pain in the *right* lower quadrant several months before accompanied with fever.

On admission her appearance was that of a woman acutely ill. There was moderate abdominal distention with general rigidity more marked over the left lower quadrant and midline below the umbilicus. No mass to be felt. Pelvic and rectal examination negative except for tenderness high up in cul-de-sac. The condition suggested a left-sided appendiceal abscess.

The abdomen was opened in the midline from umbilicus to pubes. Considerable fibrinous exudate and mattings of the intestine and omentum were revealed. The lower sigmoid was found hard, fixed and adherent with a dense indurated mesentery. The gut for about three inches was partly gangrenous, and for a total of *six inches indurated, fixed and in questionable condition of viability.* Resection of the sigmoid and upper two inches of rectum was done with cautery between clamps. Anastomosis at time was considered inadvisable both because of the *infection and peritonitis* and *condition of the patient.* Left inguinal colostomy was considered wiser. Drainage to pelvis by tube and rubber dam. Rectal end closed by inversion stitch and dropped back. This patient made a very satisfactory and uncomplicated convalescence. Colostomy opening has worked admirably, no prolapse, as gut was drawn down from above until moderately tense. Patient naturally now wants it closed. He was not greatly inclined to attempt it, as the difficulties would be unusually great from adhesions and

lack of fresh peritoneal surfaces, distance of separated gut ends and inflammatory thickening of mesosigmoid. He proposed sending her to the hospital for X-ray determination of intestinal position as a guide to the decision.

There were two small poutings in the sigmoid wall some three inches above the site of the resection—large calibre diverticula, so called—but not of the type which cause trouble. Hence it was decided to save this area and not extend the resection. The small probe or pin point tracts into the wall of the gut or mesentery are undoubtedly the anatomical causes of the disease.

Dr. Joseph Wiener said that about two years ago he had a patient, a man of forty, who had an acute attack of abdominal pain, mostly on the left side; but he had a history of a possible pre-existing appendicitis; also tenderness on the right side. A consultant who was called in agreed that he probably had both appendicitis and diverticulitis.

On opening the abdomen he found a distinctly diseased appendix. He tried to pull the sigmoid into the wound but found he could not. There was an extensive diverticulitis and the walls of the sigmoid were very thin.

He turned in the wall of the sigmoid with a row of linen sutures at the site of the diverticulitis, and closed the abdomen, leaving a small drain at the lower angle. The man made a prompt recovery and he has had no return of the trouble. Judging from the appearance of the sigmoid, he would probably have had a perforation in twenty-four hours.

ILEUS DUE TO GALL-STONE

Dr. Franz Torek presented a woman, seventy-six years of age, who had been admitted to the German Hospital showing the characteristic signs of ileus. She had been constipated for four days and had vomited for three days, but the most prominent symptom was cramps of extreme intensity from which she had been suffering for three days. Peristalsis was visible.

A diagnosis as to the causation of the ileus was not made. There was no previous history of gall-stones.

Operation revealed the presence of an enormous gall-stone (see Fig. 16) in the upper or middle portion of the ileum. The intestine above the stone was dilated, that below it was collapsed. The stone was held so tightly in the intestine that it could not be moved in the slightest degree. It was removed by enterotomy. In the region of the gall-bladder that organ was concealed beneath dense adhesions connecting it with the neighboring organs, a condition which would nat-

urally be expected where a gall-stone had passed from the gall-bladder into the intestine by perforation of their walls.

The recovery was prompt and uneventful in spite of the patient's advanced age.

The calculus weighed 50 grammes and measured 8.6 cm. in length and 3.4 cm. in width. A small scraping showed it to be composed of cholesterin and bile pigment.

FOREIGN BODY, POINT OF A SCISSORS, IN THE KNEE-JOINT

Dr. Franz Torek presented a woman who had fallen with her knee on a scissors, which broke under the fall. She was unable to find the point of the scissors. She noticed an insignificant wound below the patella, but was not aware that the point had entered her body.

On the third day following the accident she walked to the hospital complaining of chills and of some fever and showing the site of the puncture which was apparently sealed and showed no signs of inflammation. The admitting physician ordered a röntgenogram to be taken and instructed the patient to return on the following day. This she did, again coming to the hospital on foot.

The röntgenogram is of interest, inasmuch as it shows that the point of the scissors is directed forward (see Fig. 17), although it must have gone in in the opposite direction, point first. It had therefore changed its position after it had entered the knee-joint. On opening the joint the foreign body was found exactly in the position shown by the röntgenogram, the point forward and slightly upward. The synovial fluid was turbid but not thick. A culture of this fluid proved to be sterile. After a moderate amount of cleansing the joint was closed without drainage, a procedure which did not disturb the successful outcome. The patient's highest temperature was 100.6; from the third day on it was normal. The function of the knee is perfect.

SESAMOID BONE IN PATELLAR LIGAMENT

Dr. Franz Torek presented a boy, fourteen years old, who had noticed a swelling and redness of the knee for about five weeks. He had no spontaneous pain, only a tenderness on pressure over the swelling. The accompanying röntgenogram (Fig. 18) shows in profile the condition of the knee, and the front surface of the removed specimen is shown in Fig. 19. The specimen was partly bony and partly cartilaginous. It was removed through a longitudinal incision in the middle of the tendon, the fibres of which completely covered its anterior surface and also the two lateral margins. None of the fibres were behind it. In direct relation to its posterior surface was the in-

FIG. 16.—Gall-stone removed from ileum on account of obstruction of bowel caused by it.

FIG. 17.—Portion of scissors blade broken off in the knee-joint.

FIG. 18.—Sesamoid bone in the ligamentum patellæ. Transverse X-ray view of the affected knee-joint.

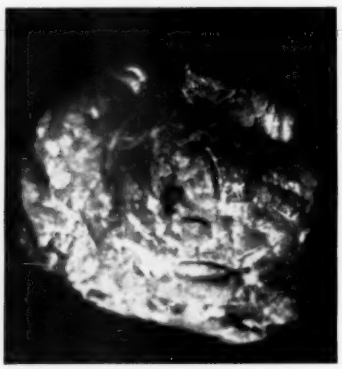


FIG. 19.—Sesamoid bone removed from the ligamentum patellæ.

frapatellar bursa, which was congested. There was no communication with the knee-joint.

The separated fibres of the patellar tendon were reunited by catgut sutures. The function of the joint is perfect.

The author has been unable, thus far, to find any reference to a similar case in the literature.

GASTRO-ENTEROSTOMY UNDER LOCAL ANÆSTHESIA, FOLLOWED BY PYLORECTOMY UNDER ETHER

DR. JOSEPH WIENER presented a man, fifty-nine years of age, who was admitted to the First Surgical Service of Mount Sinai Hospital, September 11, 1916. His family history was unimportant, except for the fact that one sister had died of cancer. The man had always been well until three years before admission. At that time he began to complain of nausea and marked constipation. The nausea gradually grew worse and vomiting set in. Two years ago he was at the Post-Graduate Hospital for three weeks and last year he was at the Beth Israel Hospital for three weeks. At each of these hospitals he had been treated without any relief. Recently he complains of epigastric distress, nausea a few minutes after eating, followed by vomiting which gives him relief. Of late he has also been complaining of moderate pain in the back. He had not seen any blood in the vomitus or in the stools. He had lost 20 pounds in three years, and on admission weighed only 87 pounds.

On examination a small, hard, freely movable tumor was felt in the epigastrium. Owing to the extreme emaciation and poor general condition the operation was done in two stages and the first under local anæsthesia.

September 14, 1916: Posterior gastro-enterostomy; novocaine and adrenalin anæsthesia. The transverse Sprengel incision was made on the left side and a typical Moynihan gastro-enterostomy done with Connell sutures. A hard tumor the size of two walnuts was found in the pyloric region; no enlarged glands were felt, but the lumen of the pylorus was very small. The abdomen was closed without drainage. In spite of the fact that there were some omental adhesions around the stomach, the operation was done under local anæsthesia and the man complained of no pain. During the following three weeks there was some improvement in the general condition. The nausea and vomiting stopped and he gained a little in weight.

October 5, 1916: Pylorectomy under general anæsthesia. The abdomen was opened through the former site of operation. The tumor

in the pylorus had increased considerably in size. About half of the stomach was removed and the duodenum was divided as far from the tumor as possible. Omental adhesions around the stomach added to the technical difficulties. Three layers of linen sutures were used to close the stomach. The duodenum was tied off with a heavy linen ligature and two layers of linen sutures buried the stump. The omentum was sutured over the duodenal stump, and the abdomen closed without drainage. The pathological diagnosis was carcinoma. The wound healed by primary union except for a small fistula probably communicating with the duodenum. This fistula is still present. The man has gained fifteen pounds since the first operation and he is still gaining in strength.

APPENDICECTOMY AND COLPOPERINEORRHAPHY UNDER LOCAL ANÆSTHESIA

Dr. Wiener also presented a woman in whose person he had removed the appendix and repaired the perineum under local anæsthesia.

The patient had had appendicitis for about six months. Just as he was closing up the skin wound she informed him that she had laceration of the perineum and asked if he would operate on that under the local anæsthesia. The technic for appendicectomy he had been developing for about a year. He had had fifty cases, seven acute and the others chronic. By the intelligent patients he had been assured they have had extremely little pain. One of these patients was a physician and the doctor assured him he had little or no pain and the only discomfort was the moment the cæcum was being drawn into the wound and was drawing on the mesentery. If the technic is the proper one, the pain is practically nil.

The reporter invariably, in doing the appendix operation, makes the intermuscular incision, and there is a technical reason for that. A number of men have said they tried to do it through a right rectus incision and it is not a satisfactory operation because the cæcum does not lie directly under the incision. One has to draw the small intestine toward the median line, whereas if one does an intermuscular incision, this falls away. He rarely has had to put in a packing.

In women he makes the incision down lower than in men so that if necessary he can resect the right ovary. In men he makes the incision intermuscular, but makes it somewhat higher.

Dr. George Woolsey said that he had a case of gastric ulcer with hæmatemesis that was so exsanguinated that he did not dare give general anæsthesia and he did a gastro-enterostomy with pyloric exclusion

under local anæsthesia without any marked pain. The man was getting oxygen from time to time. He tried it also in another case afterwards, but although he thought he might have completed it, the traction caused so much pain that he finally gave a general anæsthetic.

The difference in the second case was that the patient was quite stout and required a great deal more traction on the posterior parietal peritoneum. It is an operation that can be done under local anæsthesia readily enough in thin patients.

Dr. Winfield S. Schley said with reference to abdominal operations under local anæsthesia that many of them are very possible after a moderate working of the technic for a short time. He had had a number of gastro-enterostomy cases under local anæsthesia. The thickness of the abdominal wall makes a great deal of difference in the ease of operation. He first tried it in major work eleven years ago, after returning home, having seen much of this work abroad. He had used novocaine with adrenalin, as he thought it had an advantage over any other local anæsthetic in that the combination diffuses remarkably from the site of injection and really does its own infiltration. After animal experimentation he found the toxicity of novocaine exactly one-sixth that of cocaine and when combined with adrenalin in small amounts it was about one-twelfth, an extremely safe and satisfactory anæsthetic agent. Personally he had relegated local anæsthesia to selected cases, those in critical condition or with organic disease, or where it is essential to shorten the period of general anæsthesia, such as in a case of an old man of seventy-two, a neglected suppurating gall-bladder, in whom he did an entire local down to the gall-bladder and then under gas-oxygen completed the operation in about five minutes. It was astonishing how quickly the operation went and how little disturbance it caused. Local anæsthesia has distinctly a place in surgery and a field of its own in selected cases.

THE TREATMENT OF BONY DEFECTS OF THE LOWER JAW

Dr. Clarence A. McWilliams read a paper with the above title, for which see page 283 (March).

BOOK REVIEW

GUNSHOT INJURIES. By COLONEL LOUIS A. LAGARDE. Second revised edition. New York: William Wood & Company, 1916.

As a result of the European war the material available for a book upon this subject is enormous. There are fifteen chapters in this book dealing with technical considerations:—Characteristic lesions caused by projectiles, symptoms of gunshot wounds, infection of gunshot wounds, treatment of gunshot wounds. Gunshot wounds of the different parts of the body are taken up separately. The thirteenth chapter describes the casualties of battle. Chapter fourteen considers medicolegal phases of gunshot wounds, and the last chapter, chapter fifteen, describes the X-ray apparatus used in the field. A part of the preface to the second edition of this book gives a fairly accurate idea of what has been added to the original edition, and likewise gives a very satisfactory brief statement in the author's own words of the subjects of importance covered.

The book is a concise text-book. It proves to be interesting reading. Professor LaGarde has filled an immediate need by completing this new edition. Much will necessarily be added to subsequent editions to bring the subject up to date with the ever increasing experiences of the world war. The book is on gunshot wounds. We would like to have had thoroughly handled the treatment of fractures by splints and apparatus as used in this war in connection with both wounds and fractures. This might have taken the author too far afield. However, the treatment of the wound alone can not be apart from the apparatus for immobilization and ambulation. The book has an academic atmosphere all through. One wishes the author had gone into more detail and cited more particular cases to illustrate practical points.

CHARLES SCUDDER, M.D.

CORRESPONDENCE

DEFINITION OF MAJOR AND MINOR SURGERY

A QUESTION AND AN ANSWER

St. Paul, Minn., April 12, 1917.

Annals of Surgery,
Philadelphia, Penn.

Dear Sirs:

By law the State of Minnesota permits osteopaths to practise minor surgery and prohibits them from practising major surgery. The Ramsey County Medical Society has been requested to define just what is meant by minor surgery and what is meant by major surgery. Our Society referred the question to a committee of which I am chairman.

On behalf of the Society and its committee, I wish to thank you in advance for any information which you can furnish us on the subject.

Fraternally yours,
Robert Earl.

April 17, 1917.

Dr. Robert Earl,
1014 Lowry Building,
St. Paul, Minn.

My Dear Doctor:

Answering your letter of April 12 to the Annals of Surgery.

As its Editor, I would say that major surgery includes all work requiring a general anæsthetic; all operations which involve openings into the great cavities of the body; all operations in the course of which hazards of severe hemorrhage are possible; all conditions in which the life of the patient is at stake; all conditions which require for their relief manipulations, for the proper performance of which special anatomical knowledge and manipulative skill are essential.

I think these general statements cover pretty generally what is meant by major surgery. You will see that there is still left an abundant field for the practitioner of minor surgery.

Very truly yours,
Lewis S. Pilcher.

GALL-BLADDER FILLED WITH CALCIUM CARBONATE PUTTY

EDITOR, ANNALS OF SURGERY,
Brooklyn, N. Y.

DEAR SIR:

I wish to submit a report of a case of gall-stones, the interest in which attaches to the X-ray plate and the contents of the gall-bladder. The patient was a girl, 20 years of age, who since 14 years of age had suffered from dull, continuous pain in the right abdomen; at intervals attacks of vomiting with severe pain; no jaundice; at times pain below the right scapula. She has been very much troubled with catarrh of mucous membranes. One sister died from jaundice at 18 years. A second sister had an operation for gall-stones.

Patient herself was thin, frail and weak, and had tenderness over her whole right abdomen and right flank. The X-ray gave the picture shown in Fig. 1. On operation the gall-bladder was not thickened; its contents were ordinary gall-stones embedded in a putty-like mass which almost filled the gall-bladder and cystic duct, and which proved to be, on examination, pure calcium carbonate held together with a very small percentage of mucous matter.

Patient recovered quickly after gall-bladder was drained and a catarrhal appendix was removed.

In the X-ray photograph the clearer spaces represent the gall-stones.

Yours truly,

F. W. C. MOHR, M.D.,
Ottawa, Canada.

May 2, 1917.

To Contributors and Subscribers:

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FIG. 1.—Gall-stones embedded in a mass of calcium carbonate partly filling the gall-bladder.

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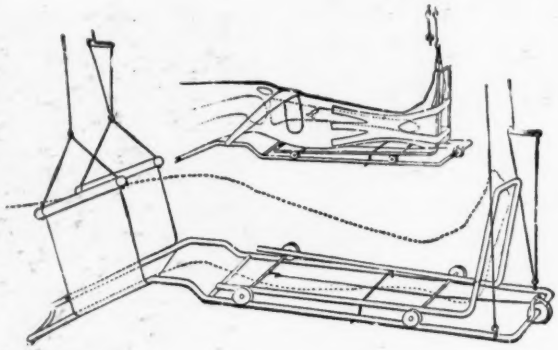

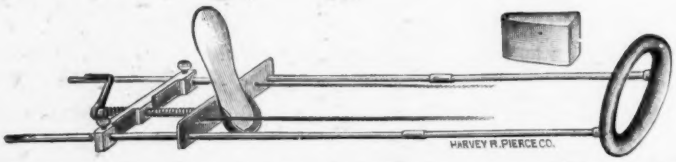

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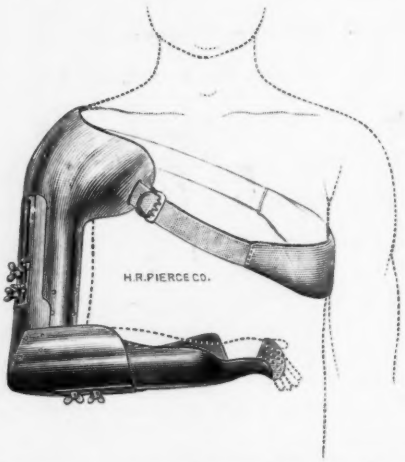

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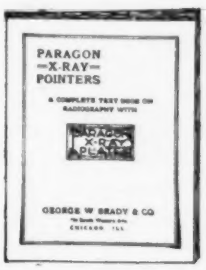

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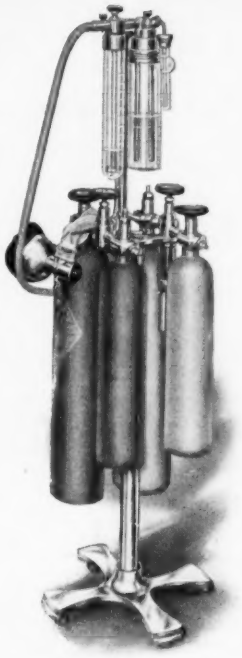

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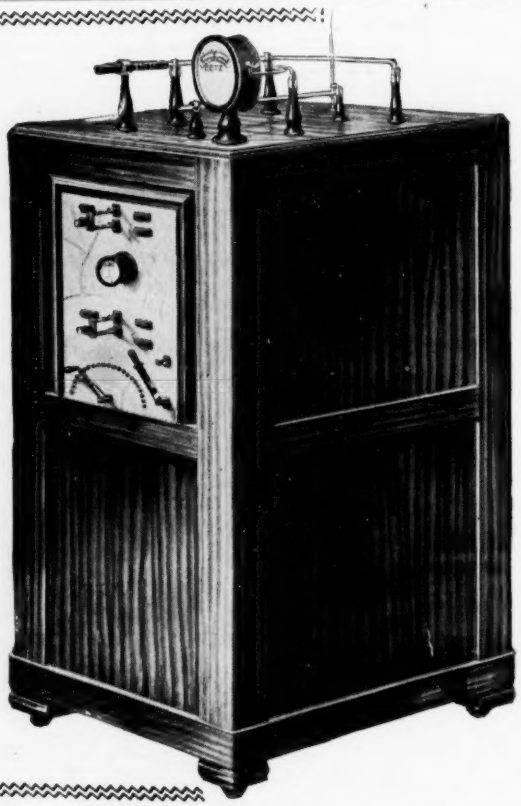

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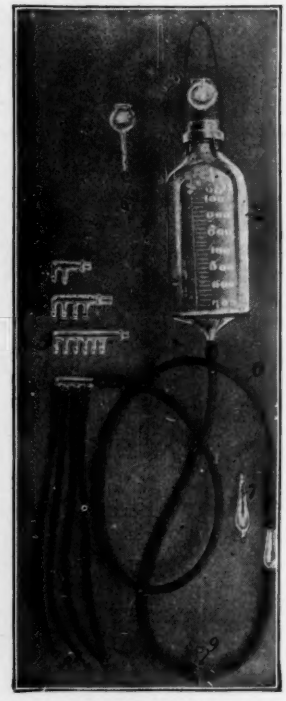

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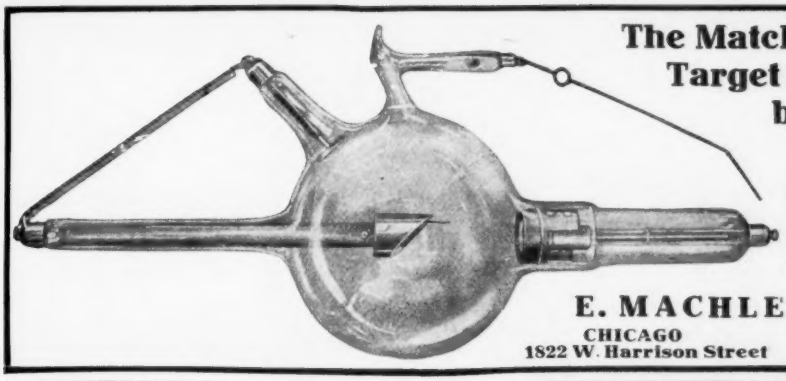

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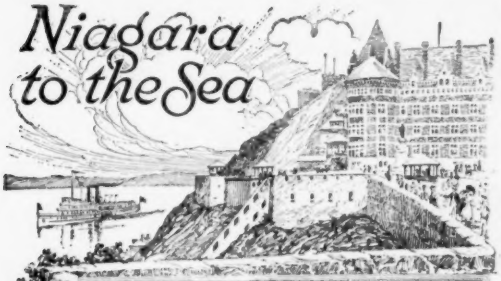

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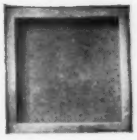

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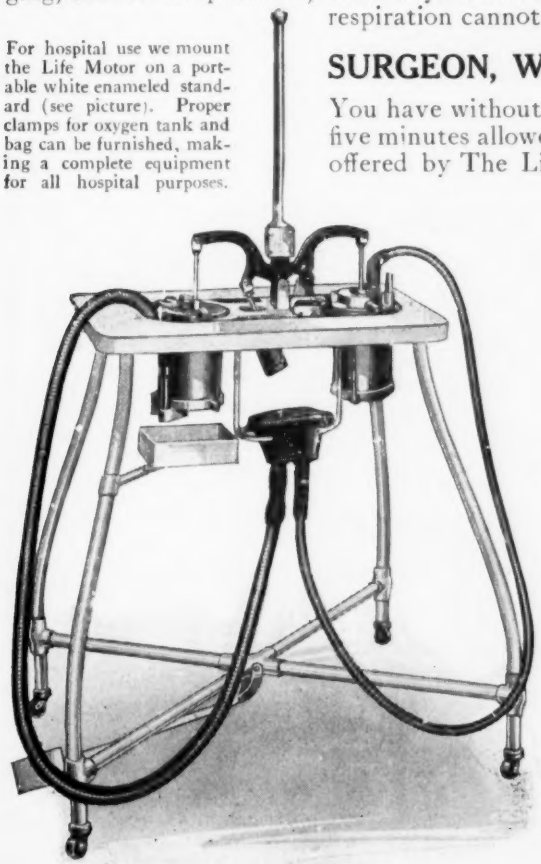

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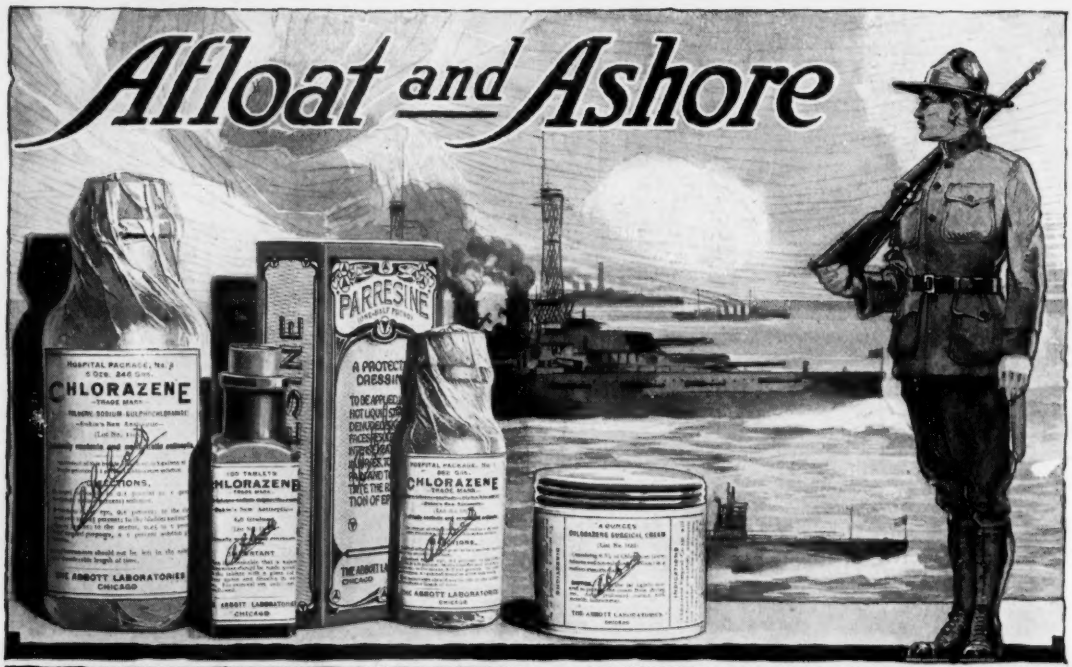

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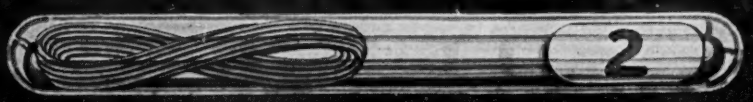

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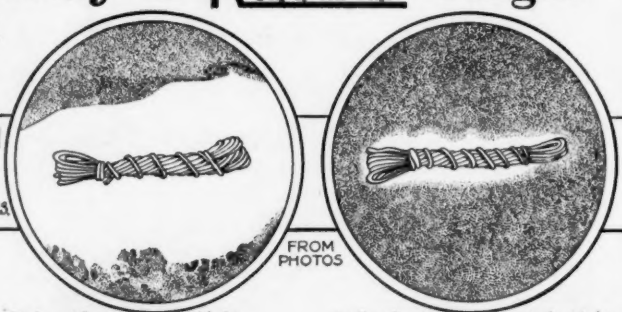

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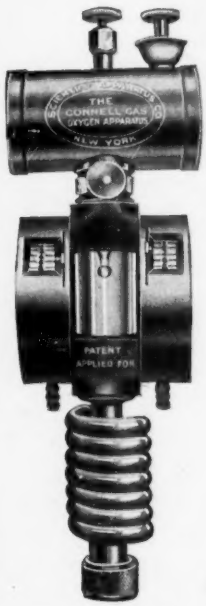

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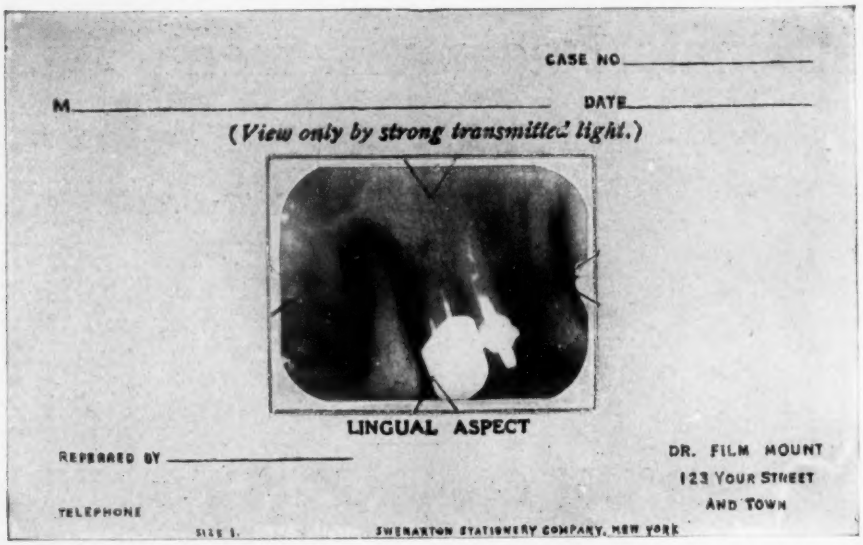

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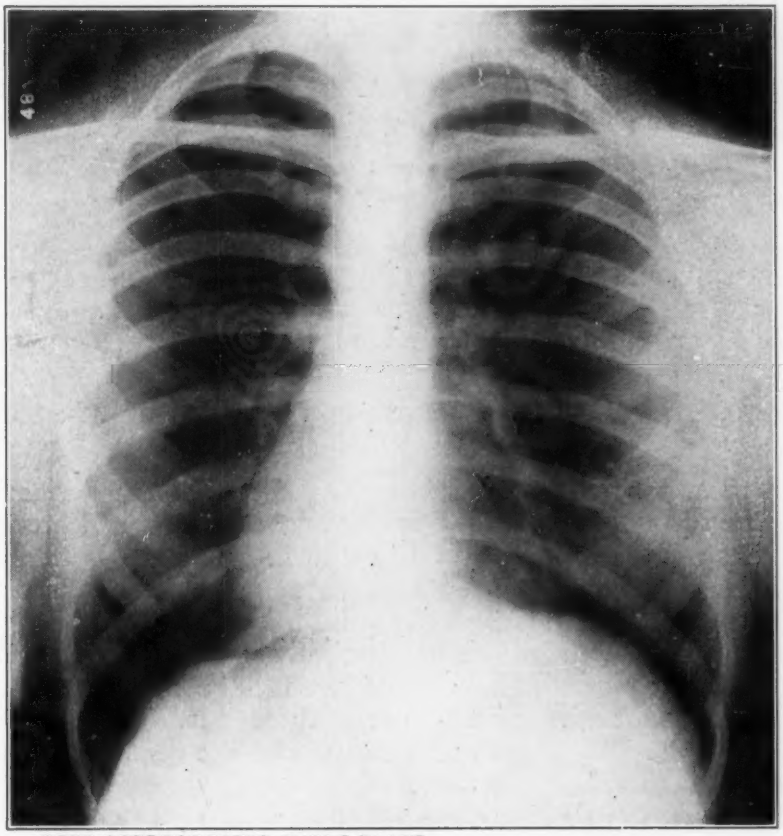

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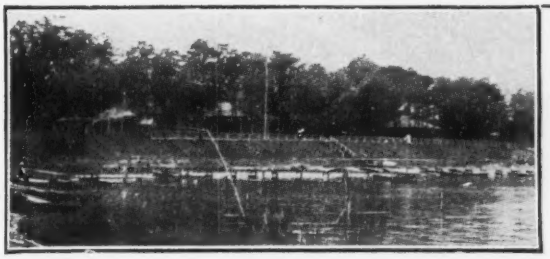

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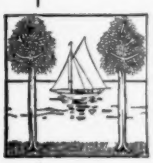

MOTOR ROADS

The motor roads from both New York and Philadelphia to Point Pleasant are excellent. From NEW YORK CITY through scenic Staten Island to Tottenville, across the ferry to Perth Amboy, to Red Bank and over the famous Rumson Road to Asbury Park, then along the coast through Spring Lake to Point Pleasant and Pine Bluff Inn makes a week-end trip worth while. 70 miles. From PHILADELPHIA take ferry to Camden, then to Morrisville, to Moorestown, Mount Holly, Lewistown, New Egypt, then through beautiful Lakewood to Point Pleasant and Pine Bluff Inn. Distance, 72 miles through the pines of Jersey.

Let us send you one of our folders telling more about it.

GOLF on our own private 9-hole course.

TENNIS: Three of the finest tennis courts in New Jersey.

CANOEING and SAILING on the beautiful Manasquan River.

BATHING: One of the best bathing beaches along the coast.

FISHING and CRABBING.

MOTORING: The roads for miles in all directions are unsurpassed. Eight miles from Asbury Park. Hotel Garage.

BARNEGAT BAY, the mecca of fishing grounds, one mile from the hotel.

For Mother and Child

After prolonged lactation a mother's milk usually decreases in quantity and nourishment. It is then that a properly prepared liquid extract of malt and hops would not only increase the volume of breast milk but the amount of its fat content. But to accomplish this, it must be a **real** extract of malt and hops and not a cheap imitation.

ANHEUSER-BUSCH'S
Malt-Nutrine
TRADE MARK.

is the recognized standard of medicinal malt preparations and is prescribed by eminent physicians for the mother and child at the nursing period. It is made of the choicest barley-malt and Saazer hops and contains all the soluble substances of these two materials.

Pronounced by the U. S. Internal Revenue Department a

PURE MALT PRODUCT

and not an alcoholic beverage.

ANHEUSER-BUSCH, St. Louis

A FOOD TONIC, POSSESSING THE BENEFICIAL PROPERTIES OF BLOOD SERUM AND RICH IN HEMOGLOBIN

BOVININE

Specially indicated in Anemic Conditions. Mal-Nutrition or Mal-Assimilation.
Convalescence. Gastric Disturbances, acute or chronic.
Diphtheria. Typhoid, Scarlet, and other Fevers.

Irritation or Ulceration of Intestinal Tract.
Consumption and all Wasting Diseases.
Cholera Infantum, and all Infantile Disorders.

Influenza, and Recovery therefrom. Diarrheic and Dysenteric Conditions.
The Puerperal State. Nursing Mothers.
Rectal Feeding, Topical Application, etc.

Write for Sample, also for one of our new (sterilizable) Tongue Depressors.

THE BOVININE COMPANY
75 West Houston Street **NEW YORK CITY**

We are pleased to announce to the Medical Profession the introduction of a

SMALL SIZE (6 oz.)

Gray's Glycerine Tonic Comp.

(FORMULA DR. JOHN P. GRAY.)

The most important reasons for this new departure are briefly:

1. **A convenient size for ℞.**
2. **To meet the conditions occasioned by the "high cost of living."**
3. **To insure proper filling of your prescriptions, and as a guard against Substitution.**

The regular 16 oz. size will be continued as heretofore. We trust this innovation will be as cordially received by Physicians as has the 16 oz. size for the past 25 years.

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The Winkley Artificial Limb Co.

Largest Manufactory of Artificial Legs in the World

Inventors and Manufacturers of the

LATEST IMPROVED

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DOUBLE SLIP SOCKET

Artificial Leg

Warranted not to Chafe the Stump

PERFECT FIT GUARANTEED from Casts and Measurements without leaving home

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United States Government Manufacturers

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This cut shows leg for amputation six inches below the knee, with inside socket thrown out of its proper position in order to show its construction.

Parathyroids—
Powder and Tablets, 1-20 grain.

Red Bone Marrow—
(Medullary Glyceride) Hematogenetic, Histogenetic.

Corpus Luteum—(True Substance)
Powder, Tablets and 2- and 5-grain Capsules.

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Elixir of Enzymes—
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Pituitary, Anterior—
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(*Armour*)

A pure, potent preparation of the Posterior Pituitary Body. Uniform and reliable alike, in surgical and obstetrical work.

PITUITARY LIQUID (*Armour*) is entirely free from local anesthetics and other objectionable preservatives.*

PITUITARY LIQUID (*Armour*), standard strength, is supplied in two sized ampoules, 1cc and 1/2 cc, 6 in a box.

*Vide Hygienic Laboratory Bulletin No. 109.

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